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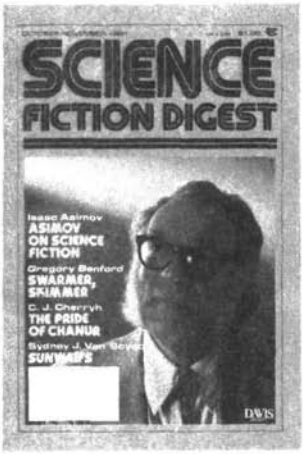

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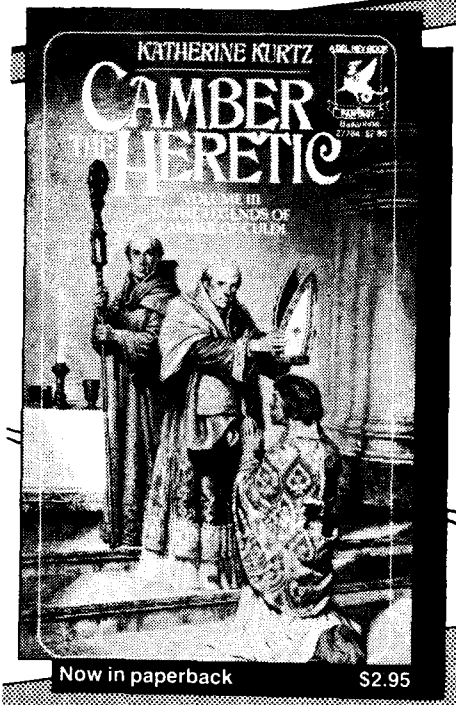

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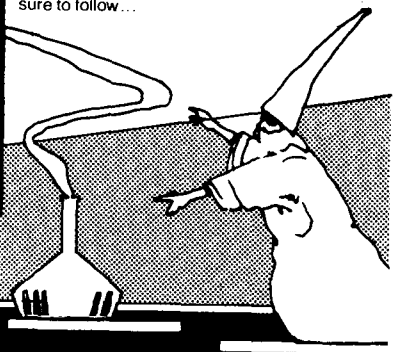

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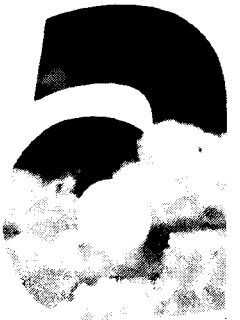

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Guest Editorial

The Territoriality Of Space Exploration

John G. Cramer

The spectacularly successful maiden voyage of the space shuttle *Columbia* has thrust the U.S.A. back into manned spaceflight in a very dramatic way. But in the euphoria of our recent successes let us not forget the great success of a decade ago—the landing of Apollo 11 on the Moon—and the strange loss of interest in the space program by the U.S. public which immediately followed that event. Somehow, after Apollo 11 the excitement of our landing on the moon rapidly drained away, and the subsequent lunar landings were lacking in some essential ingredient. We were no longer really interested. The Conquest of the Moon had unexpectedly gone flat. John Kennedy's dream of providing the nation with new national goals through new frontiers in space had failed.

What went wrong? Until we can answer that question, even those of us who are enthusiastic supporters of the space program will be perpetually off balance. For how can we advocate any sort of long-range program in space research and exploration if we cannot rely on the support of the public, if our greatest successes will somehow create an atmosphere of boredom and rejection among the taxpayers who are paying for the enterprise? It is important that we soon gain understanding of the public's strange reaction to Apollo 11, for although public support for the space program is now very high, its support in Congress is not particularly high and could fall much lower in the present atmosphere of budget-slashing. The shuttle program must succeed psychologically as well as technically, or the space program is doomed to more decades of decline.

I would like to offer an explanation of what went wrong after Apollo 11, based on the sociobiological concept of *territoriality*. We of the human species are not strictly rational creatures, despite what we would like to believe about ourselves. Beneath our rational processes lie intrinsic drives and motivations, which well up from an underbrain inherited from our man-ape ancestors. Our motivations, our loves and hates, fears and desires arise somewhere in this dark underside of the brain. Human institutions (like the space

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program) which are to succeed for more than a brief period of history must mesh with the things which motivate human beings. And the things which motivate human beings are not exclusively high ideals and purposes; they are also things which happen to tickle the human underbrain in the right spots, perhaps because they once provided some tribal/group survival value to our man-ape ancestors.

We are just beginning to understand the nature of a few of these tickle spots. One of the most important of these was first identified in the early decades of this century by H.E. Howard, a British businessman and amateur bird-watcher. It is the concept of *territoriality*. In many of the animal species, individuals (usually males) before finding a mate (and thus contributing to the gene pool of the species) must stake out and defend a territory which is uniquely theirs, repelling all rivals of their species. This is the reason, for example, that songbirds sing; not, as the poets have told us, to express the joy of existence, but to tell all other birds of their species: "This is my territory! Stay the Hell away from it!" This behavior has survival value because it ties reproduction to the limits of geography, automatically limiting the population to a size that the local ecology is able to support. Species which are not territorial and thus do not have this natural regulation mechanism are subject to large cyclic swings in the size of the population: cycles of depopulation, rapid buildup, and culmination in a climax of overpopulation and rapid die-off. The famous "suicidal" behavior of lemmings is an example of this climax behavior in a non-territorial species.

Human behavior lies somewhere between the extreme territoriality of songbirds and the extreme non-territoriality of lemmings. We are somewhat territorial as individuals, as family units, and as tribes, groups, or nations. If you doubt this, observe the suburbs of any city from the air and ask yourself why the land is carved up into little squares with a house in each one. Why not put all the people together in one big building and use the land for parks and forests, streams and lakes? Because each of us *likes* to have his own little patch of ground, his own *territory*. Why is the map of the Earth's land masses divided up into colored blobs with the name of a nation attached to each? Because as national groups we feel the same way. We need to establish and maintain a *territory*.

I would like to suggest that what was missing from Neil Armstrong's first step on the lunar surface was the territorial punchline. We went to all that trouble to go to the Moon, and then *we didn't claim the territory!* Our high ideals and goals had been fulfilled, but our underbrains had not been properly tickled, so the event was an anticlimax.

Let us try to rewrite the script of the Apollo 11 landing, and to assess within ourselves what the impact would have been. Visualize with your mind's eye the same event, Armstrong's first step on the moon, with a slight modification. This time, let us edit out the "One small step for man . . ." line. Instead, the spacesuit-clad figure of Neil Armstrong

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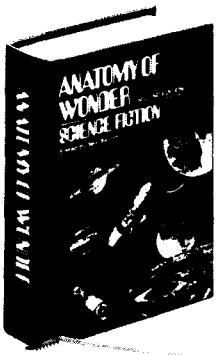

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lumbers down the ladder of the lunar lander with a long stick-like object clutched in one glove. Slowly he turns. He unfurls what is revealed to be a light plastic flag. He plants the Stars and Stripes in the rocky, irregular soil of the Moon. And slowly and with great emotion, he says, "I claim this territory in the name of the United States of America!"

That's what was missing. That is why we felt let down. The territorial punchline wasn't there. We went all the way to the Moon, picked up some 49 pounds of rocks, and left without claiming it as ours. We cannot look up at the Moon and say, "That is our Moon, our Territory!"

There were, of course, many good rational reasons for not claiming the Moon as a territory of the U.S.A. It would have been greedy. It would have been impolite. It would have been imprudent. It would have had international repercussions. It would have been an insult to the other nations of the world. It would have seemed neo-colonial. The rest of the world would have protested and sued in international courts. We would have been denounced in the UN. We would have sent the Russians into a frenzy. They would have been driven to expend tremendous efforts to make their own lunar landing and claim their own chunk of lunar territory so that we wouldn't get it all. We would have had to establish a Moon base to protect our own real estate. International tensions would have moved into space. We might have had to fight a war there. But in all probability we would, at this moment, have men and women living and working on the moon.

On balance, I believe that it would have been worth the risks involved in staking our claim on the Moon. In retrospect it is clear that we have incurred at least as large a risk by not having much in the way of a national purpose, by losing our initiative and our momentum in space, by leaving to the USSR the establishment of the first permanent space station and probably the first moonbase, by running our space R&D efforts like a weathervane to the winds of political fashion and expediency.

But all of this is ancient history. It is too late to go back and claim the Moon as a United States Territory, even if we wanted to do so. We are already a party to a treaty stating that no nation can claim the Moon as its territory. Our government was, until recently, on the verge of signing the Moon Treaty, which would have made the Moon into a sort of International Park which no individual or corporation could own any part of and which nobody could exploit, except in a very limited way, for national or commercial purposes. Suddenly, there was a great public outcry against the Moon Treaty, and its signing now appears unlikely.

This strong public reaction is perhaps a symptom of our unease at our loss of the Moon as territory. The present slow but definite gain in popularity and support of our national space effort may also be attributable to the reintroduction of anticipated territorial gains into manned spaceflight in the form of space colonies. The enthusiasm for Gerard O'Neill's idea of mounting a national effort to build an L-5 space colony may very well be rooted in the fact that it

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would be our territory. We would not build it "in the name of all mankind" but as our personal property, to be defended, cared for, and enlarged. We are slowly arriving at the realization that the *prime real estate* in space is not the moons and planets, with their troublesome gravity wells, but presently empty points of stability such as the L-5 points of the Earth-Moon system, where we are free to construct our own environments to suit our needs. The Moon is perhaps not a place to live and "conquer." Rather, its smaller gravity well is a mineshaft from which we will obtain the raw materials for the space colonies which will be our real Territory.

Some, even if they accept the above arguments, will find it quite reprehensible that territoriality must provide a driving force of mankind's first ventures into space. One-World idealism and altruism are far more aesthetically appealing and "sanitary" as motivations. But we have tried the high road of international altruism with the Apollo program, and it has proved to be a treacherous dead-end highway. The engineering of human institutions, like all other forms of engineering, must make the best advantage of the available materials. An important material we must work with in the enterprise of space exploration is the not-completely-rational and rather territorial human species. This material is not likely to change in the near future. If we are going to venture into space, we must carry with us the baggage of our man-ape ancestors. I believe that this alternative is a better one than not going at all. ■

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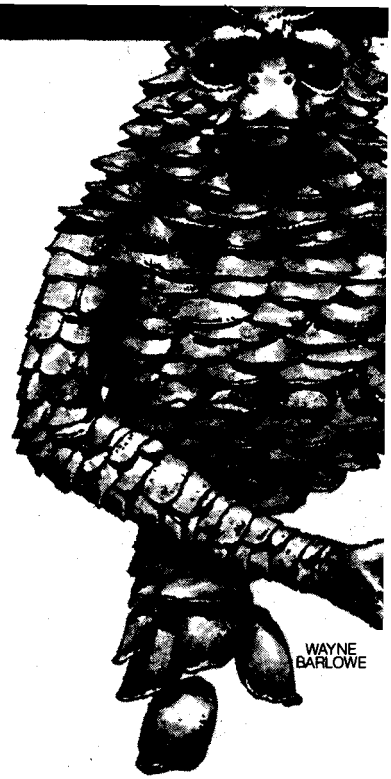

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Look to the Rose that blows about us—"Lo,
Laughing," she says, "Into the World I blow,
At once the Silken Petals of my Being
Tear, and my Treasure to the Great Winds throw."
—Rosan translation of the Lazarine translation of the English translation of the *Rubaiyat* by Omar Khayyám

Sorrel Everwood felt his ears slowly being amputated; he reached up to adjust the damn strap on his infrared goggles a tenth time. While he was there, he adjusted the coloration control as well.

At last the Rosan he faced looked like the Rosans in xenoanthropological films. Hundreds of delicate cooling fins, the Rosan equivalent of scales or feathers, covered his body. He seemed to be wearing flower petals, petals of deep red laced with a fine network of pink veins. His wide, gentle eyes were violet with flecks of gold. The gold in his eyes matched the gold in his medallion, the medallion of the ruling Bloodbond.

Some of his petals were curled, and turned green toward the edges. *Or Sae Hi Tor must be old for a Rosan*, Sorrel decided before concentrating again on the Bloodbond's words.

"I assure you we'll give you all the help, the highest priorities, available." Or Sae spoke slowly in logitalk for the humans. "Obviously we stand to gain even more from a translight communicator than you do. And I hope that—"

Or Sae rose suddenly from his chair, heading for the exit passage. "I'm sorry," he murmured. "May you die by a . . . rising . . . " He crumpled to the floor.

Sorrel was already moving toward Or Sae. Wandra screamed. The screaming made Sorrel turn, and as he turned he realized what was happening. Thus, when he turned back to Or Sae, he was not surprised to see a pool of green brainblood seeping from Or Sae's head, solidifying into jelly. Nor was he surprised when a sweet, gentle scent, disturbingly like honeysuckle, filled the air.

Sorrel hadn't known he still had it in him to hate; he had been so long so tired and so resigned. But sitting there with the Lazarine, the hate came back to him, along with fear and defiance. "Why me?" he asked harshly, or at least as harshly as he could manage with the fear in his throat.

Balcyrak Kretkyen Niopay blinked slowly. "Because you are the most qualified being in the universe. Isn't that obvious?"

Sorrel said nothing; yes, in some ways it was obvious.

The Lazarine laughed—a resounding sound, which faded slowly. "I'm sorry—I know that for you it's not a laughing matter." A robutler entered; Balcyrak pointed to the serving tray. "Refreshment?"

"Thanks." Sorrel took the warmed liquor glass, containing . . . well, he wasn't sure what it contained, but it was probably costly, certainly good, and hopefully soothing to a dry throat. As he sipped, Balcyrak changed the subject.

"We know how much you hate us."

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Sorrel coughed, inhaled sharply.

"And also why. I am sorry about your wife. We are sorry for all who die too soon, regardless of how many Lazarines those sentients may have killed, regardless of how involved we may have been in killing them in return."

Sorrel's wife had been an officer on board a human flagship when Man chose to fight Lazaran, before Man overcame his brooding jealousy. So long ago . . .

"But the work is, in our opinion, too important for historical phenomena, however recent, to interfere. You are the galaxy's foremost authority on Rosans, knowing them even better than they know themselves—in fact, you are the only sentient ever to have transformed an alien culture without force of weapons. That is quite an achievement; it may be said that you are the only successful xenopsychologist ever born."

"Without force of weapons?" Sorrel felt fiery horror. "Millions of Rosans died in the revolution."

Balcyrak waved it away. "But they were killed by other Rosans, the Rosans who could understand the superior regenerative society you offered them. Have you ever read Darwin?"

Sorrel snorted. "I don't have time for reading ancient history."

"Of course; I am sorry to mention it. No matter. The deaths were just a manifestation of the fittest surviving. Because the six-parent religion was su-

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perior, it destroyed the four-parent religion. After all, the superiority of six-parenthood inspired you to write your dissertation in the first place. The people of Khayyam are lucky that Prim Sol Mem Brite read it.''

''Yeah. But not so lucky he killed so many of his own people because of it,'' Sorrel frowned. He wanted to argue, but this was neither the time nor the place. ''Look. Why don't you go to Khayyam yourself? Why do you need a human as your local overlord?''

The Lazarine frilled his mane in distress. ''You will not be an overlord; you will be an associate. Humans are the only beings who can be effective as interfaces between the ideas that originate here and the applied engineering that will originate there. We cannot do it ourselves. It is too . . . painful. For them as well as us.'' He paused, watching Sorrel, speaking softly. ''You've never been to Khayyam, have you?''

Sorrel shook his head. It was an intolerable irony that he should never have visited the planet of the people whose lives he had transformed. He had never met a Rosan in his entire life; he had merely written a dissertation about them, in school, shortly after his wife's death.

And with the dissertation he had caused so many new deaths.

Balcyrak interrupted his thoughts. ''Fear not, Man Everwood. You will understand why we can't go ourselves after you've been there a while. After you've become like a Lazarine unto them.''

''What?!'' Sorrel wrenched forward in his chair.

The Lazarine smiled; he seemed languid, almost uncaring, but then all Lazarine activity seemed languid by human standards. ''When you are Lazarine-like, you will understand.''

Sorrel realized that Balcyrak was assuming he would take the job, assuming that he would go to Khayyam as Balcyrak's proxy. Even more infuriating, Sorrel realized that Balcyrak was right.

''You'll see,'' the Lazarine promised.

Wandra took a large gulp from the glass Sorrel had given her; she was still shaken from the death of the Blood-bond. The three humans were back on the ship, though they hadn't yet taken off their coolsuits. The coolsuits made them look like pale, ragged Rosans, as far as Sorrel could tell.

Wandra spoke. ''I just don't believe it. I know, I know; everything I had read about the Rosans before coming here warned me about their deaths, and I should've realized that it'd be a casual occurrence.'' She took another gulp. ''But dammit, I still don't believe it. How could somebody be that way?''

''It's simple enough,'' Cal started with his cool, sarcastic voice. ''You'd be that way too if you only had 36 hours to live. You don't have time to pay too much attention to somebody else dying.''

Sorrel sighed. Cal was going to be a problem; already he was building a shield of cynicism to insulate himself from the wounds this planet could leave. But then, Wandra's hysteria boded ill as well. ''It's not quite that simple, Cal. Though the adult phase of the Rosan life cycle lasts only 36 hours, they pack a lot more life into those 36 hours than most humans pack into a hundred years.

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The main reason death isn't a cause for grief is that it's so necessary for the children; a Rosan can't, after all, have children in our sense of the word unless his brainblood is preserved for the larval bloodfeast." Sorrel shrugged. "For that matter, the bloodfeast confers a bit of immortality to every Rosan; the bloodchild starts adult life with many of the memories of the bloodparents, and much of the knowledge of the brainparents."

Cal snorted. "Yeah. Immortality. The kids remember everything. Only problem is, you're still dead. Hell, you might as well write a book—that's about as immortal as a Rosan can get."

"And that's probably a lot more immortal than any of us will get," Sorrel said, and immediately regretted its saying; Sorrel, after all, already had that kind of immortality.

Cal stalked from the cabin.

Sorrel watched Wandra pace across the deck, watched her wring her hands in agony. "Yes, Wandra, what do you want to tell me about Cal?" he asked at last.

Wandra paused in mid-stride. "I, uh . . ."

Sorrel nodded his head. "I'm supposed to say that since I'm a psychologist I analyzed you and already know what you want to say. Unfortunately, it would hardly take a psychologist to see that you're disturbed—more disturbed now than you were before Cal left."

She sighed, sat back down. "I suppose you're right. Look, Dr. Everwood—"

"Sorrel," he said, "My name is Sorrel."

"Right. Sorry. Do you know how Cal

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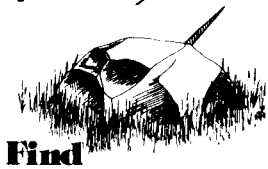

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happened to become a part of this expedition?''

''Not really. I confess I've wondered about it. He doesn't seem like the type to volunteer for a job like this.''

''He didn't—not exactly, anyway. He's a flunk. Blew his postdoc thesis at U. of New Terra. Since he couldn't make it as a theoretician, they consigned him to engineering. Apparently that's a big loss of prestige where he comes from.''

Sorrel nodded. ''Yes, on Narchia it would be. So he came out here to get as far as possible from the embarrassment.''

''Yeah.''

Sorrel shrugged. ''Well, at least he should be successful at getting far enough away. Lord knows, there's nobody here to bother him.'' Except for Sorrel himself, he realized; his ''success'' would be a continual insult to Cal. He looked at Wandra; she looked back, knowing his thoughts as he had just known hers. ''So who's the psychologist now?'' he murmured.

She laughed, the first time since planetfall.

Sorrel stood up. ''Let's go back and meet the new Bloodbond. He should be settled in by now; we have lots of business to discuss.''

The office had changed little; the Bloodkeepers had taken the remains of Or Sae Hi Tor to the larval gateway, so the next returning larva could take him in bloodfeast. The stacks of papers in the out-slot of the desk seemed larger; those in the in-slot seemed smaller. Tri Bel Heer Te was a member of the current dayspinner ruling bloodline. They directed the MoonBender cavern works during the 36-hour daylight half of Khayyam's cycle, as Or Sae's bloodline ruled during the nightspin half of the planet's revolution.

Tri Bel rose to greet him with a touching of petals along the forearm. The gold, silver, and green medallion of the Bloodbond glinted with splendor. ''My children will remember this meeting forever,'' she said, giving the traditional greeting. With Sorrel, the greeting might well be true; Tri Bel looked upon Sorrel in raptured awe. Her wide, bright, Rosan eyes were wider than usual, and Sorrel had the uncomfortable feeling that this was how she might look upon a god.

''We will remember you in our books,'' Sorrel said, using the closest human counterpart of a racial memory. ''And even the Lazarines shall sing our songs, should we of Earth and you of Khayyam succeed in our plans.''

The awe surrendered to the press of business in just a few seconds—still a long time in Rosan terms. ''I wouldn't be surprised. Let's talk,'' Tri Bel said. The Rosan gestured for Sorrel to take the resting incline at the head of the conference table; Sorrel uncomfortably sidled to one of the others. He wasn't a god, dammit! Why did they have to treat him like one?

Sorrel spoke, as fast as he could, in Ancient Rosan (Ancient Rosan being several years, or hundreds of generations, old); he didn't want to waste any more of Tri Bel's time than necessary. ''Do you know what we were discussing with your predecessor?''

''No, I haven't had time to read his lifescription yet.''

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"The significant information we bring is this," Sorrel ticked off. "The Lazarines have developed a universe-gestalt incorporating methods of faster-than-light communication, methods much faster than sending messages on starships. Cal Minov and Wandra Furenz, the other two humans with me, have translated the Lazarine gestalt into a practical theory. Now all we need is a massive engineering effort, to find a workable implementation of the theories. The Rosans, of course, are the fastest, most efficient engineers in the universe, and the project is so large it'd take any other beings decades of effort. Here on Khayyam we hope to cut that time to less than a hundred generations." Sorrel scratched at his goggles. "When we're done, your descendants will be able to talk to beings on other worlds and receive answers within their own lifetimes."

The Rosan should have been bored with this slow aimless speech—but because this was Sorrel Everwood, the One Parent of the Faith of Six Parents, she was not. Besides, the merits in FTL communication were truly awesome. The merits were especially great for the Rosans, who were isolated on Khayyam by lifespan as well as by distance. Tri Bel's tragic smile seemed a bit human, yet a bit elfin as well. "Man Everwood, again you bring us salvation. How can we repay such a debt?" She shook her head. "Have you spoken with our scientists and engineers? Have they seen the plans?"

"No, we've been waiting for a Bloodbond's authorization."

"You've waited hours, just for a Bloodbond?" Tri Bel's eyes filled with puzzlement, then cleared. "We must arrange for the work to begin. Send Man Minov and Man Furenz to the Bel Dom laboratories at once." She shook herself. "I can't believe you waited hours for authorization!" She moved to her desk. "Your project has Priority 1A, the pick of the engineering pool and all material resources, as well as the right of bloodfeast selections, with higher bloodfeast priority only for Executive Bonds. Further, your techs have fully expanded egg-laying rights. The orders shall be ready within the hour."

Sorrel's head spun; the FTLcom was being backed with resources far beyond his wildest expectations. Bloodfeast selection would permit them to mix and match the brainbloods of the best FTLcom workers in each generation, to selectively shape the chemogenetic skills and blood memories of the next generation ever further. And fully expanded egg-laying rights would make positions in the project extremely valuable, since FTLcom workers would be permitted to have more than two replacement eggs, as well as multiple brainchildren and bloodchildren. "Thank you," he said to the Rosan, who was already speaking into the room's transceivers. He listened for a moment, but couldn't understand a word; both because it was modern Rosan, and because Tri Bel spoke impossibly fast. Sorrel left immediately; though Tri Bel never would have dismissed him, Sorrel knew she couldn't work effectively with a god in the room.

There were almost 200 quiet, expectant Rosans listening there in the stone hall. Sorrel cleared his throat.

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"I want to apologize for the crowding. It looks like our cavern is a bit small for our task. However, a new cavenet is nearing completion, and we've been assured that it'll be ours once it's ready." Sorrel realized it wouldn't make any difference to these students, who would pass into bloodfeast long before the new accommodations were complete. "Anyway, this is Calvin Minov, a spacetime physicist, and this is Wandra Furenz, a topocurve mathematician. Since I know absolutely nothing about faster-than-light communication, or spacetime, or anything that has to do with engineering, I'll give the floor to them."

Cal climbed the low step stiffly, followed by a smiling Wandra.

Sorrel looked at Cal. "Cal, why don't you start off, give them an idea of where we're going, how, and why?"

"Yeah, sure, uh," he turned to the class and froze. Sorrel pressed a copy of the manuscript explaining the theories into his hand—a manuscript that Cal had written. "Just tell them what you know, Cal," he whispered in Anglic.

Cal looked down at the book, seemed to remember where he was, and turned to the lightboard, calling up the first diagram. Sorrel stepped down and examined the roomful of FTLcom students.

They were the best, chosen by Sorrel in consultation with the Chief Geneticist and the Assistant Coordinator of the Bloodkeep; each student had six good parents with backgrounds in science, engineering, or mathematics behind him. The students were young as well, with fat still in their cheeks, not only because young ones would have more time to assimilate more material, but also because only a youth would sit still for the slow ambling ways of humans.

Sorrel turned his attention back to the teacher. Cal, cool and aloof though he might be, was warming to his subject. He talked faster and as he went along, and he talked still faster as he realized that no matter how fast he talked his students would keep up with him. In fact, Sorrel knew, the worst mistake Cal could make would be to talk too slowly, for then his students would lose concentration.

Ooops—one of them asked him a question, with such swift sentences he couldn't follow . . . there would be a great deal of adjusting to do. Not to mention the problems it would pose if the humans got too attached to any of the Rosans they taught. . . . At least Cal might be immune to that, but Sorrel could see long, terrible times with Wandra. He'd have to take a very close look at her ego chart. For the first time Sorrel felt that he belonged on this trip, not just because he would awe the natives and make things move swiftly, but because he would be useful as well.

A right arm wrapped itself around his left, and Wandra whispered in his ear. "Well, I think Cal's going to do all right without us. We're planning to take two-hour shifts in the teaching with one-hour breaks after each pair of lectures, so the students'll have a chance once in a while to behave like normal Rosans. How does that sound?"

Sorrel nodded. "We're playing this all by ear, so your suggestion sounds as good as any. We'll see how it goes with this group, and readjust later. I've got a feeling that two or four hours of

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humans talking is too much at a shot, but we'll see."

Wandra had been gently tugging him out of the room while he talked. Two Rosans in an electric wagon whooshed by with a load of tunneling equipment. Wandra plopped onto the cool stone floor and Sorrel followed, awkwardly falling over her as she dragged him down. She laughed, beautifully, and he laughed as well. She shook her head. "I was getting so tired standing there in the lecture hall, I couldn't wait for a chance to sit down," Wandra said.

Sorrel nodded. "Yes, I've got the feeling all my blood went into my legs. I think we'll have to install a few chairs here and there in strategic locations around Khayyam. Either that, or do some genetic engineering on the Rosans so they need chairs too—that way we can invent the chair for them and make a huge profit, selling cushions."

Wandra laughed again, a wonderful human sound. Rosans knew laughter too, but it was a swift, chirping sound, the laughter of hummingbirds. There was no time for rich melodies here on Khayyam.

Wandra's laughter cut just a bit short. "Were you watching the engineers while you were speaking?"

Sorrel sighed. "Yes, I was."

"They worship you."

"I know."

The silence hung heavy in the still, dry air. Wandra spoke again. "I know you did something special for these people once, but frankly I'm amazed by how they remember you. That was hundreds of generations ago, wasn't it, whatever you did?"

Sorrel sighed. "Yeah, but the Rosan memory is long and fickle."

Wandra just stared at him.

He exhaled slowly. "Especially, they remember their gods."

She nodded. "Brek Dar El Kind said something like that."

"Brek Dar El Kind?"

"One of the students."

"Um." Long pause. "Did he tell you of the Faith of Six Parents?" She shook her head. "Well, it's the main religion of Khayyam. In fact, it's the only religion here in the MoonBenders Cavernwork. The followers of the earlier religion were wiped out here in a war some years ago. Shortly after I finished my dissertation on Rosan culture, as it happens."

"Um. Coincidence?"

Sorrel clutched his head in his hands. "I'm afraid not. You see, I invented the Faith of Six Parents." He shrugged. "Oh, it wasn't a religion when I invented it, it was just an idea—but when my idea got mixed with real beings on a real planet with real problems, it became a religion." He took a deep breath.

Just then they heard someone—or something—skitter around the corner. The something made sharp clicking steps, much different from the Rosans. "Freeze," Sorrel ordered Wandra.

He turned toward the sound. Sure enough, a krat hunched there, eyeing them hungrily.

The man and the krat looked at each other for a long time, there in the tunnel. The krat's petals were more ragged than Rosan petals, and a vicious scar gouged the length of his left side. The small but tough creature approached.

An electric cart whirred down the

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passage toward them, and the krat vanished.

Sorrel noticed his hands were shaking, and his brow was damp despite the dustiness. "They really aren't very dangerous," he said, as much to himself as to Wandra. "Usually the krat don't bother adult Rosans. But the Rosans recently started another big extermination push on the krat, and hunger makes them bolder."

Wandra squeezed his arm. "Thanks," she said, before looking him in the eye with some amusement. "You were telling me about your dissertation."

"Ah yes." Sorrel took a deep breath. "I guess I'll give you the whole spiel."

He exhaled slowly. "I'll start with the Rosan lifecycle. Rosans have two sexes, pretty much like humans, except they get along better." Wandra hit Sorrel in the arm, and he laughed. "Anyway, each pair of genetic parents produce several eggs. The eggs hatch in about a year, and the larvae take off into the deserts. These larval Rosans are tough beasts, tough enough to survive repeated exposure to Khayyam's sun. The larvae grow and fight for about two years before returning to the place of hatching. At that time they metamorphose into adults." Sorrel felt Wandra's breath upon his cheek, and enjoyed the warmth of having a woman near again. It had been a long time. "The last act of metamorphosis is the bloodfeast, in which the larva consumes the bulk of the brainblood of its bloodparents. From the bloodparents the larva gets many memories, opinions, and attitudes — foremost are the memories associated with the parents', uh . . ." What was a human equivalent? Sorrel winced. "Their *purpose*, I suppose. Except the *purpose* is also transmitted in brainblood, and it takes generations to change the direction of the brainblood's purpose, even if one of the individuals in the bloodline is fanatically dedicated to a different purpose." Sorrel shrugged. "Anyway, the larva also feasts on a part of the brainblood of the brainparents and receives some of their memories as well—though the brainparent memories are stripped of emotional associations. You could think of the brainparent memories as being collections of highlighted *facts*, and the bloodparent memories as being both facts and *beliefs*." Sorrel chuckled. "Actually, there are theorists who think that *all* memories are passed, even though only a part of the bloodmemories are remembered. But it'd be hard to prove—no Rosan could live long enough to remember that many memories anyway. Especially since the individual Rosan has a photographic memory, as far as his own life is concerned. Just remembering one parent's whole life would be a lifetime affair."

Sorrel stood up, dragging Wandra with him as she had earlier dragged him. "Let's walk." Their direction led away from that of the krat's departure. "Since the larvae always return to their hatchplace for the bloodfeast, genetic parents tended to be the bloodparents as well. Thus there were four parents.

"But after the invention of the shovel, civilization developed inside the caverns, where Rosans could live both day and night. In this new environment the identity of genetic and blood-parents was no longer necessary; in fact, it was a severe hindrance to progress. Since

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the egg and larval stages last three years, the memories of the great scientists and philosophers missed a hundred generations of civilization between incarnations." Sorrel's voice turned bitter. "That's where my distant, objective eye came into play. I saw something better. You see, if they used a different larva—a larva that reached maturity just as a person died—the person's memories wouldn't have to wait for three years. No, that person's memories could be incarnated the next day." Sorrel shrugged. "The Rosans themselves never saw this possibility. I wouldn't be surprised if there's an instinct for having genetic parents as bloodparents. Not that an instinct was needed anymore—the correspondence of genetic parents with bloodparents was institutionalized in the Faith of Four Parents. The religious leaders, of course, vehemently opposed the six-parent concept."

"So there was a war."

Sorrel nodded. "War isn't common among Rosans—it takes too many generations to make a change that way. Assassination and brainblood-burning are more common. But when they have a war, it's a total war in the finest human tradition." *Like the kind we waged against the Lazarines,* he thought. "The Faith of Six won, of course; no one in the universe can beat the speed with which a six-parent Rosan culture can make advances in experimental sciences like weaponry, because no one else could conduct so many experiments so fast as a series of determined generations of Rosans."

"Which is why we brought the FTLcom here, to be done swiftly."

"Yes." Sorrel looked at his watch. "You know, if you hurry, you'll *still* be late for your part of today's lecture."

Wandra stared at his timepiece, turned and rushed down the tunnel. Sorrel laughed, watching.

Cal never learned their names.

Their faces and their names changed, but their minds stayed the same—as each tech on the FTLcom project died, the Bloodkeepers fed his brainblood to the next, best returning larva. There was one class for the dayspinners and one for the nightspinners. The minds were constant within those two groups.

Too constant. Day after day Cal would answer the same questions—sharp, insightful questions, but still the same questions. Oh, the Rosans always knew all the facts before they came to class: they read all the textbooks beforehand. With photographic memories it was a breeze. Yes, they knew the facts—but to *understand* and *manipulate* those facts was another matter, and facts without understanding simply wouldn't transmit through brainblood. The brainblood absorbed abstruse mathematics in tiny increments; to produce a clear imprint would require generations of effort.

Sorrel and the Bloodkeepers told him that soon their determined screening and selection of bloodlines would produce engineers who remembered FTL hyperspace mechanics with facility, for whom the brainblood's *purpose* was directed toward this kind of learning. But for now there was a slow, painful learning process.

So Cal would teach. Incredibly swiftly they would learn, and then the new faces would come the next day, having for-

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gotten. So Cal would teach.

Until one nightspin he met Dor Laff To Lin. She was delicate and graceful, even for a Rosan. Her mouth quirked into a laughing smile at the slightest provocation. Better yet, she asked new questions.

New questions! Her brain- and blood-parents had passed their knowledge and their understanding in brainblood, and Dor Laff knew it all. She knew, perhaps, as much as Cal himself, and when she reached midnight age Cal no longer knew answers to her questions. He blustered and flushed at her; she laughed and worked with him. She taught the rest of the class to help him, to help him find the answers to her new questions, digging ever deeper into the vitals of the Universe.

Cal had never known a woman with whom he could laugh and work, nor had he ever been a member of a team, a leading member at that: though Dor Laff controlled the discussions, it was Cal's mind that was central; it was Cal's mind that was tapped for knowledge and insights. They pushed him beyond the seeming limits of his creativity, to see new truths, and then they took his truth and ran with it farther and faster, in many directions, than a human mind could go.

But Cal didn't have time to be disturbed by their superiority—for as one group ran off with a new idea, Dor Laff would bring him back to work another track, another direction, to send another group racing in another new direction. Never had Cal felt such exhilaration; never had he known such joy in living. Never had he loved so deeply someone who had given him so much.

Dawn approached; the brightness in Dor Laff's eyes was fading, but Cal was too flushed with victory to notice. He half-sat, half-fell to the edge of the lecture platform. Waves of exhaustion caught up with him. "Dor Laff, you're a miracle," he told her in ecstasy.

She knelt beside him and touched his cheek. The gentle petals of her hand brushed across his forehead. "Will you remember me?" she asked.

He looked into her eyes. "Of course I will."

She hugged him. "Thank you, thank you for letting me touch your immortality." She turned. "Good-bye."

He called to her, but she was gone for the moment. The fatigue of 30 hours of concentration took him; he slept.

When he woke, she was gone forever.

" . . . and things are going remarkably smoothly, all in all," Sorrel was saying into his dictalog when Wandra's call came through.

"Sorrel, we've got a problem here," Wandra yelled above the background sound of an angry crowd. "Cal's lost his cool, with a vengeance. We'll be lucky if they don't lynch us."

"Stay calm," he urged on his way out the door. "Be with you in a flash."

The FTLcom cavern had changed a great deal since the last time Sorrel had seen it; corners here and there contained the beginnings of pieces of equipment that would've given Euclid headaches; some were shrouded to prevent glances into the gravwarps being generated. There were nearly 400 Rosans there now, all murmuring to one another. Cal stood before them, cursing and pleading in anguish. "Why don't you remember?

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Why are you asking me the same thing again? Why do you question me? Listen to me, please!" Several of the Rosans had left their inclines and gathered near the front platform.

A dozen Rosans saw Sorrel enter the room and hurried to him. "Man Everwood, what should we do?" they asked, with reverence in their eyes.

"Nothing," he replied grimly. "Don't let any Rosans touch him. I'm gonna have enough trouble with him as it is." He turned to Wandra. "How tough are you in a fistfight?" Sorrel asked in Anglic.

"Brown belt in modkido. How 'bout you?" She barked a short, tense laugh.

He shook his head. "I'm too old, I'm afraid. I'll distract him; you grab him. Wish we had more manpower, but if the Rosans tried to touch him, he'd really go wild."

"They'd only get hurt, anyway—too fragile," she commented as they moved in on the podium.

"Cal," Sorrel yelled above the noise, "A shuttle just arrived from New Terra! There's a message for you!"

Cal stopped cold. "What?"

Wandra rushed him. He flailed, and Sorrel ran up to assist Wandra. A few minutes' struggle left Cal tired and sobbing.

"Take him back to his cave?" Wandra asked.

Sorrel shook his head. "The ship. Let's surround him with as much humanness as we can. He's suffering classic culture shock."

They picked him up, started him moving out of the cavern. "Classic culture shock? I never heard of anybody frothing gibberish because of culture shock before."

"Well, almost classic culture shock," Sorrel grunted. "You've gotta admit, this culture has a lot of shock in it." He bit his lip, and together they dragged Cal's limp body back to the ship.

Sorrel had never been a practicing psychologist, at least not to the extent of hanging out a shingle and looking for lost psyches. But it seemed to be his main function on this trip; perhaps Balcyrak had known all along that this would happen.

The psychologist took a deep breath, but otherwise retained a professional calm. Apparently this episode had been triggered by the death of a Rosan woman. Sorrel cursed himself for thinking Cal's aloofness would protect him; the aloofness had made him all the more vulnerable, once someone broke through the shell.

At the moment Sorrel was sitting quietly next to Cal, who lay on an accelerator couch pouring forth his soul. Freud would have loved it. Sorrel did not. It had taken great effort even to get Dor Laff's name, and Cal still didn't acknowledge her as his source of pain. "Is that the only problem with the Rosans, Cal? Are you sure?"

Cal nodded. "I can't stand it. Every day I teach the same thing, again and again, and the faces are *different*." The last ended in a howl of horror. "Every day different, never the same person twice." He whimpered. "Please, let me have just one student twice."

Sorrel shook his head. "Don't they remember, Cal? Don't they ever, from one day to the next? Just one thing. Can you remember?"

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"Well . . . just a couple of things. Not much. Always the same questions . . ."

Wandra knocked at the open door of the cabin; Sorrel waved her in. "How's he doin', Doc?" she asked, attempting to be light and cheery.

"Cal's as fine as ever, of course. I think we'll spend the rest of the afternoon here, though. Can you manage the courses by yourself?"

She nodded. "You bet, Doc. Stimpills and me, we've got what it takes."

"Yeah, I'll bet. Next Cal will have to take the whole show for two days, while you recuperate."

"Faith, Doc, faith. Catch ya later." She was gone before Sorrel could speak again.

He turned back to Cal. "You were telling me what else bothers you about the Rosans, besides the fact that they forgot every day."

"I was?" Cal twisted his head to Sorrel. "I, uh, I guess there is something else. They don't remember too well, but . . ." Cal's shoulders shook as he sobbed. "They're, they're smarter than we are. I just don't believe how much smarter they are. So fast, so sharp. Every day I say the same things over again, but every day they learn it again in just a matter of minutes." He rolled over, away from Sorrel, and mumbled into the couch, "God, what I'd give to be able to think as fast as they can."

"Would you give your life for it, Cal? They do."

"I know, I know, but . . ." He rolled back over, smiled through the tears. "My old quant prof, Durbrig, used to tell me my problem was that I wanted it all. I guess I still do."

"I guess, so, too. I envy you that, Cal. I wish I still had enough hope to dare to want it all." Sorrel stood up. "Stay here until, oh, maybe 5100 hours, and come on back to the cavernwork. Think you'll be all right?"

"Yeah." He smiled, crossed his arms as Wandra would. "Sure thing, Doc."

The new nightspin Bloodbond was different from the earlier Bonds; this Sorrel could tell already, and he hadn't even met the being yet. But so far three other Rosans had gone in to see the Bond, leaving Sorrel to cool his heels for upwards of two minutes—a short but significant wait. Earlier, Sorrel had received immediate service, regardless of how important the other callers were and how precious their time was. It had always made Sorrel uncomfortable, before, but now its absence left a trace of anxiety nibbling his mind.

As the third Rosan left, Kik Nee Mord Deth beckoned him. "What, Man, want you?" he asked in peremptory Rosan.

"Equipment," Sorrel replied as smoothly as he could manage. "FTLcom tech bloodmemories firm now. Prototype construction begins. Trouble develops acquiring these items." He held out a list to Kik Nee, who snatched it, skimmed it, and thrust it back to Sorrel.

"Precious items," he commented. "Needed elsewhere."

"Priority 1A on FTLcom," Sorrel replied almost haughtily. That internal haughtiness surprised Sorrel himself. He'd never imagined himself pushing for the prerogatives the first Bloodbond had granted him, but Kik Nee rubbed

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him the wrong way. "Impediment intentional?"

The Rosan exhaled sharply. "Much work waits," he almost pleaded. "Let it progress. You need not speed, you have time."

And that, Sorrel knew, told the whole story. *You have time*, the Bloodbond knew, and hated. Jealousy haunted the Rosans at last. Sorrel cleared his throat. "I'm sorry. I've not treated you justly." Sorrel moved forward, took an incline. "But that equipment is needed. Without it the project halts. Though I can wait, engineers cannot. I waste not their lives." Sorrel remembered an old analogy, from the Rosan past. "There's an old bit of Rosan poetry—have you read Gesh Lok Tel Hor?"

The Rosan's lips drew back in disgust. "No time for ancient history."

Sorrel shook his head, blushed. "Of course not," he mumbled. "I'm sorry, again."

Kik Nee turned to the next waiting Rosan, who rushed into rapidfire discussion—again Sorrel was embarrassed at how much the Rosans had to slow down to talk to humans. But Sorrel wasn't done here yet. "Equipment?" he demanded in a loud, human voice, over the hummingbird sounds of the Rosans.

Kik Nee turned to him, head slumped ever so slightly. "Yours," he acquiesced.

Sorrel left with much food for thought.

Balcyrak stood with his back to Sorrel, watching the darkening sea, while the wind whipped his fur. Sorrel shivered, though the air was warm—on old Earth, the feeling in this evening air would have meant a storm coming.

Balcyrak turned as Sorrel approached. "You must see a sunrise while you are on Khayyam, Man Everwood. Do you know of them?"

Sorrel nodded. "I am, after all, the expert on the planet, right?"

Balcyrak chuckled. "Then tell me this, expert. From whence did the planet get its name?"

Sorrel tilted his head in thought. "You've got me there. I know it was discovered by a Lazarine, but Khayyam doesn't sound like a Lazarine name."

"It is not. The leader of the Lazarine expedition that landed on Khayyam was an expert, if you will, on Man. Omar Khayyam was one of your own poets. The Lazarine explorer named the planet for the human author who wrote so eloquently of a species similar to the people of Khayyam." He paused, looking again to the sea.

"Yes, Look—a thousand Blossoms
with the Day
Woke—and a Thousand scattered in
the Clay
And this first Summer Month that
brings the Rose
Shall leave Another's gentle Petals,
once blown, to lay."

Sorrel cleared his throat. "It does seem apropos, at that."

Balcyrak turned back to the human. "Yes. And now I have a warning for you."

"Oh?"

"Watch out while you are on Khayyam, my friend-to-be. When you arrive, you will be honored, but it will not last. You will prove too alien to them, and a love/hate bond will form. It will prove cyclic. First they will love,

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then they will hate, then they will love again." The Lazarine's hand clenched and unclenched as he spoke. "Much as Man loves and hates Lazaran," he whispered to the wind.

Sorrel squinted at him. "I see." Sorrel moved to stand shoulder to shoulder with Balcyrak, at the edge of the precipice. "Why is it so important to you that the FTL communicator be ready so soon? Granted, it'll prove valuable beyond price, but why the rush? Why do you need to send people hurtling halfway across known space to get it down so fast?"

Now it seemed that Balcyrak shivered under his thick coat of hair. "I suppose you should know. I suppose it might help motivate you, as well." He paused. "There will be another war between our peoples. Man Everwood."

Sorrel nodded; though currently the peacefulness of Man's relationship with the Lazarines was sickeningly sweet, he knew there was an undercurrent of hatred, a slowly growing group of people who disliked the Lazarines as much as Sorrel himself did. "Who will win?"

"Does it matter? Someone will lose. Someone, Man Everwood, will lose everything. The next war will be a war of genocide. Our wisest consuls have studied carefully, and they know not who will be destroyed, but all agree that one or the other of our species is doomed."

Sorrel paled; he hadn't realized it would go that far.

"We need better communications, Man Everwood. The time it takes for even the starships to carry messages is too great for your people. Given better communications, and hence swifter understanding, we believe we can avert the war."

Sharp cynicism left a sour taste in Sorrel's mouth. "Communications will avert a war, huh? Just like that." He snapped his fingers. He'd heard that sort of thing before, but only from human dreamers who thought that words had substance. He hadn't expected it from a calm, realistic Lazarine.

"I don't blame you for doubting. Certainly, talk has rarely helped your species avert internal warfare. But this is considerably different." For the first time, the Lazarine's eyes refused to meet Sorrel's. "There is a . . . molding of directions involved. It is difficult to explain." Balcyrak's eyes regained their penetrating intensity. "But I am telling you the truth; communication is the answer." Now his amusement returned as well. "This also is something you'll understand better after working with the people of Khayyam."

Sorrel pursed his lips; Balcyrak's sincerity made a believer of him. "I confess, the urgency of the project seems somewhat greater now than it did a few minutes ago."

"I thought it might. Yes." A particularly strong gust of wind pushed them back from the cliff just as the sun sank beyond the horizon. They turned back to the path. "And remember to see a sunrise while you are there, Man Everwood. It is special indeed."

Sorrel squeezed through the narrow passage into the fresh-cut cavenet. "Whew!" he exclaimed, "that's a small entrance. I didn't even see it at first. You'll have to enlarge it."

The tunneling chief looked upset.

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"Of course, Man Everwood. The entranceway is always widened as the last step, so our noise and dust disturb the rest of the cavernwork as little as possible."

"Oh. I understand." Sorrel toured the new FTLcom lab facilities with some pleasure. "Well, it all looks pretty good to me, though I don't know anything about the arrangements you need for hyperspace experiments. I suppose we should have Cal and Wandra take a look."

They squeezed back out of the cavenet. Sorrel looked again at the narrow entrance. "Wait a minute. What if we *don't* open it up now?" He pondered for a moment.

The tunneling chief looked upset again. "Why wouldn't you open it?"

"Just in case of emergencies, that's all." He nodded his head. "Chief, these labs are ours to do with as we please, right?"

"Of course."

An evil gleam entered Sorrel's eyes. "Cal and Wandra will probably shoot me for this—the lecture hall is horribly overcrowded, and they need this space now—but I think we'll leave it as is."

The chief's petals fluttered rebelliously.

"Don't widen the entrance," Sorrel said, to make his orders explicit. "We'll open it later. When we want it, I'll have one of your bloodchildren do it for us."

The chief looked like he'd collapse with sorrow. Still he managed to stutter, "Yes, Man Everwood."

Sorrel touched his forearm. "And thanks. You've done a wonderful job. We'll remember you forever."

"Thank you, Man Everwood." The chief's eyes shone brightly again.

All the Rosans are bright, Wandra thought, *but this Sor Lai Don Shee is something special, even among Rosans.*

In fact, he and his descendants could be the key to turning the FTLcom problem into a trivial task. Sor Lai's bloodfeast memories were impossibly crisp, leaving him a perfect understanding of everything his four FTLcom engineering parents had understood.

That was exceptional enough—but then Sor Lai went beyond that. He also learned new things faster than anyone else, he asked the most insightful questions, and he brought new points of view to bear on every problem. In just a few weeks he could have resolved every remaining problem in the final design, Wandra was sure.

But he didn't have a few weeks, and when the second instruction session was over, Wandra didn't want to let him go; she wanted to keep teaching him, to pack as much of her mind into his as fast as she could. She hurried from the platform, worried she wouldn't catch him before he burst from the room in normal Rosan fashion.

But he was not hurrying off with his peers; rather, he was hurrying towards Wandra, and only swift Rosan reflexes kept them from colliding in mid-step.

Wandra gurgled with laughter. "Two minds with one thought," she said. "Would you like to continue our discussions?"

Sor Lai smiled as only a Rosan could smile, with the cheeks lifting gaily and petals fluttering as though in a breeze. "Very much, Man Furenz. I would appreciate it beyond your knowing."

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She crossed her fingers at him. "My name is Wandra, Sor Lai. I hate formality."

She had to admit, she liked Sor Lai for more than merely his superior performance. She liked the naive optimism he'd shown early in the day, and she enjoyed watching that optimism develop by midnight age into a mature confidence. He knew that the eccentricities of the Universe could impede progress, or even reverse progress, but never, in the long run, stop progress.

They turned to the cavern passage. "Come with me," Wandra bubbled. "We'll go to my . . ." Wandra bit her lip; there was no word for "home" in Rosan. "We'll go to my place-of-work."

Sor Lai looked puzzled. "Isn't the lecture hall your place-of-work?"

She threw up her hands. "I have many places-of-work. This is a special one."

"I see. I think I understand."

She took him by the arm. "I see a free speedcart up ahead. Race ya!"

Sor Lai won the race, of course, laughing all the way.

They survived Sor Lai's driving, somewhat to Wandra's surprise, and stopped before the small fountain at the entrance to Wandra's cavern. "Beautiful!" Sor Lai exclaimed. "How many people worked upon this? And what does it do?"

Wandra shook her head. "I built it myself; I'm a sometimes-sculptor. It's not very good, I'm afraid. And all it does is shoot water in the air, from the fairy's fingertips, and collect it again among the green rocks beneath her feet." She turned to flick the pump switch. A thin stream danced up, spiraled down again. Sor Lai bent to touch the smooth stone, amazed. "This is the work of many lifetimes. Joyous." He rose up. "What else do Men do in their immortality?"

Wandra stammered in horror.

"Do not answer. I'm sorry." He came and took her arm. "I must see the rest of your place-of-work." They entered Wandra's home together.

Sor Lai pointed at the walls. "The pictures. Of what are the pictures?" he demanded.

Wandra looked at the scenes of Karly for the first time in weeks. "Pictures of my—" again, there was no word for home— "birth world. I had our ship computer make these up specially—they appear through my infrared goggles to look the way the originals look in normal light—normal light, that is, for a Man. So you're seeing my planet as I see it, more or less."

"These are all pictures of the surface!"

Wandra nodded. "It is gentler on my world than on Khayyam." She looked at the dry-ice-capped mountain towering above the capital and chuckled. "Though not too gentle, I suppose."

Sor Lai looked at another scene, where the sun set over a pink, powdery beach. "Those aren't Men, are they? They're too small."

Wandra followed his pointing finger. "They are almost Men, Sor Lai. They are my children. Humans metamorphose slowly, gradually becoming more Manlike."

"Your children!" He scrutinized the picture. "They laugh with grace. Have you met them? You could have met

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them, couldn't you?"

Wandra laughed. "Yes, Sor Lai, I lived with them for a long time."

Sor Lai turned back to Wandra. "Do they know your memories well?"

Wandra pondered that. "I suppose you could say they do, at least as Men go. They're more like me than their father, that's for sure. They'll be great mathematicians, someday, not housekeepers like my ex-husband." She shook her head.

Sor Lai turned slowly through the room. "And a love couch right here, in your place-of-work!"

Wandra blushed, though she wasn't sure why; she'd never thought of herself as the innocent type. "Not for a long time, my friend. I use it for, uh . . . You've noticed that Men tire faster than Rosans, haven't you? I rest there. We are unconscious for almost a third of our lives, resting."

"And still you get so many things done." Sor Lai's admiration continued.

By now Wandra's face was burning. "We do our best," she muttered. She turned to her kitchen. "Now, I have to eat something, or I'll die of starvation."

Sor Lai's admiration turned to amazement. "Eat! Like a larva?" he gasped.

"You bet," she agreed. "We don't store enough fat before adulthood to last for the rest of our lives, though sometimes it seems like my body's trying to."

At last Sor Lai was speechless. Wandra cooked, set the table, and started to eat. She talked mathematics continually, until she noticed the horror on Sor Lai's face. She felt uncomfortable. "Listen, do you want me to eat another time?"

"No, not at all," Sor Lai said. To Wandra, he seemed to be shuddering. "It's . . . intriguing."

She looked at him a while, then continued her meal.

"I remember my bloodfeast," he said, petals waving ecstatically. "It is a joy beyond imagining."

"I believe it," Wandra replied. "When we eat, though, it's nothing like that." She had heard of Rosans with keen memories of the bloodfeast ecstasy actually stealing someone's brainblood, to try to eat it—even though the adult Rosan's digestive tract is atrophied. And the ecstasy had to be strong indeed, to risk the consequences—for the stealing of another Rosan's brainblood was punishable by brainblood cremation.

They talked. Wandra finished her meal at last, and the two of them sat upon her bed, still talking. Suddenly Sor Lai clapped his hands and jumped to his feet. "You know, this hyperspace link with sound and video is all right, but the properties of the four-space beg you to generate three-dimensional pictures. Do you have a computer terminal here?"

Wandra was on her feet as well. "It begs you, huh? Well, it never begged me, but if you say so, here—" She marched to her desk and pulled out a keyboard. The wall in front of her lit up, and with quick keystrokes she logged into the Rosan central computer system.

Sor Lai crossed the room to join her. His fingers flew across the keys, and he spoke in machine-gun Rosan as the ideas developed and the machines to implement them took shape. Wandra could only stand and stare. "There," he proclaimed at last, "It's even better

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than I thought. When the FTLcom is ready, you won't even have to send a ship to deliver the construction plans to people on other planets. We'll be able to project and receive 3-D images all with one transceiver, without any equipment at the other end. Unless they throw a blast screen around your target location or some such thing."

Wandra continued to stare at him. "That's incredible."

He smiled broadly. "Yes, it is, isn't it?"

She laughed. "Even more incredible than a Man who eats even after she becomes an adult."

His smile turned quiet. "No, not as incredible as that."

They hugged each other, artificial coolsuit petals touching honest, living, roselike petals.

For the first time, Wandra became aware of how much thinner Sor Lai was now than when they'd left for her home. She looked at her watch; six hours had passed: the equivalent, in Rosan terms, of almost ten years.

Wandra jerked away. "Sor Lai!" she almost screamed. "We have to get you back!"

"I guess we should, at that," he conceded.

They speeded through the cavenets, as fast as they'd gone before, yet it was too slow for Wandra's concern. She had used up an awesome part of Sor Lai's life, just bringing him home.

Wandra tried to counter her guilt with logic. After all, the time had been productive, hadn't it? And yes, it had been worth it, hadn't it? She hurt nevertheless.

They returned to the conference cavern, where Cal was lecturing. Sor Lai took his place among his fellows, but Wandra couldn't bear to leave. She listened to Cal's lecture absently, looking among the now dawning-aged nightspinners, seeing them for the first time, watching them grow old.

The lecture ended, and a break was taken—a break to work on the two prototypes nearing completion. Wandra hovered by Sor Lai's team. Work ended, and Wandra lectured, and work continued, until dawn.

Wandra fought the tears gathering in her eyes. The curled, green-tinged petals spread inexorably across Sor Lai's body. He smiled at her sadly. "You should leave me now," he whispered. "It's time for me to go, to let my children remember."

"No, let us not waste a minute of life," Wandra choked.

The laughter in his eyes calmed. "I am tired," he said. He settled to the ground. "I'm sorry."

Wandra knelt beside him.

The air turned sweet with honeysuckle, and the flowing blood mingled with a woman's tears.

Sorrel peeked around the corner, into the interior of Wandra's home. "Anybody home?" he asked, watching her lie upon her bed.

She turned to him, tired and distraught. "Hi," she smiled wanly. "I'm sorry I haven't made it in yet. The students are probably better off without me, anyway."

Sorrel slipped in, moved to sit on the edge of her bed. "Are you sick? Did you finally find a bacterium on this planet that knows what to do with our

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proteins?''

She shook her head.

He nodded. ''I understand there was an exceptional student during night-spin.''

She nodded.

''I also hear . . . you were rather fond of him.''

She rolled away. ''God, yes. He was kind, he was beautiful, he was . . .''

''He was all good things. I know. It seems to be a common trait among the Rosans.'' He rolled her gently over to face him.

''Why do they have to die so soon?'' she yelled at him. ''Why can't they live like we do, and laugh and love and talk with their children and . . .'' She was crying.

Sorrel raised her by her shoulders, held her close. ''They can't live like we do because Nature didn't design them to live like we do. Because at the time of their evolving, death at dawn was certain. Why would Nature spend such an effort, giving long life to one doomed to die anyway?''

Wandra started rocking, bringing her legs up into a foetal position. Sorrel stroked her hair. ''You remember that krat we saw a while ago, outside the conference hall?''

She nodded.

''I saw it again yesterday.''

She looked up. ''What? The same one?''

Sorrel shrugged. ''It had the same ragged scar on its side.''

Wandra's mouth hung open, forming the obvious question.

''The krats have been luckier than the Rosans. When the Rosans moved into the caverns, they found a place free of evolutionary pressures, where they could prosper without menace. But when the krats came, they found the Rosans already here, determined to keep their caves and destroy the invaders. Thus the krats still had evolutionary pressures. Only the strong survived. Nature discovered that longevity would be useful for krats, and the krats earned longer lives through generations of bloodletting.

''But Nature doesn't choose for long life among Rosans because there is no need—and only need causes Nature to care. Nature doesn't care whether the Rosans survive with grace or joy—Nature only cares that they survive, one way or another. The Rosans can never develop longevity because they are too good at surviving without it.'' Sorrel was surprised at the bitterness creeping into his voice. ''The characteristics that make them so wonderful and worth saving are the same characteristics that damn them to mere instants of time for all eternity.''

''It's not fair,'' Wandra wailed.

''Fairness and justice have nothing to do with it,'' Sorrel continued, and this time the bitterness was undeniable. The vision of his children dying on a radiation-burned planet burned his mind. ''Nature knows nothing of justice. Only Men think of justice; it is a concept we invented, and it exists only when we can create it.''

They were both quiet for a long time; finally Wandra spoke. ''Isn't there something we can do? Intravenous feeding or something?''

Sorrel shook his head. ''That's done under special conditions, but the basic lifetime of the Rosan is built into the

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cells. Even with plenty of nutrients, the cells just stop metabolizing. It's as if they knew they were supposed to die."

"What about slowing down their metabolisms?"

Sorrel looked her in the eye. "If you could extend your life by a tenth, but to do it you had to cut your ability to live each moment of that life in half, would you do it?"

Wandra sobbed. Sorrel stroked her hair again. "I wish I could say something more soothing." His voice turned gentle again.

Wandra's arms tightened around Sorrel's chest. "Would you . . . stay with me? Till tomorrow?"

Sorrel drew a ragged breath; suddenly, he felt like the old man he sometimes knew himself to be. "I would," he said softly, "if I really believed that, in your heart, you wanted me to." He kissed her on the forehead, disengaged slowly. "I'll see you in a few hours. If you have trouble sleeping, call me." He looked down at her a last time. "Dream well," he whispered as he left.

Kir Bay played with his FTLcom medallion as he spoke. "Well, at least we still have plenty of time left. It'll be hours before the Bloodbond election. It's a shame, though, that the Supremi candidate is certain to win."

Sorrel gasped in horror. "What?!" It had been several days since Sorrel last listened to the Rosan news broadcasts. Now he cursed himself under his breath for not keeping better track; less than a week ago, the Supremi had been just another religious splinter group, with a half-sentence mention in the course of a full spin's broadcasts.

"Is it that important?" the engineer was puzzled. "It's not as if it'll kill the project."

Sorrel rolled his eyes to the ceiling. "Politicians, unfortunately, are even crazier than they seem, Kir Bay. If the Supremi get control of the government, not only will they destroy the project, they'll also destroy you—and I mean burning your brainblood, not just arranging an early death."

It was Kir Bay's turn to gasp in horror. "Are you serious?"

"How closely have you listened to the Supremi plans? They hate humans and everything associated with them. As chief engineer on our project, you're a public enemy in their eyes."

Kir Bay's petals tensed against his body. "I just can't believe it."

"Then come with me." Sorrel consulted Daisy, the starship's computer, on his radcom and found a place where they could hear a prominent Supremi politician speak.

They arrived to find a large crowd mesmerized by the fiery words of a fanatic. Few people saw Sorrel and Kir Bay arrive; those who did drew away from them in contempt, and some of them hissed in fury.

Soon Kir Bay had had enough. "You were right. We're in great danger."

Sorrel pulled him out of the Supremi cavern. "Fortunately I've made some preparations for this, though not as many as I'd planned. Damn! You people move too fast." He sighed. "Listen. Long ago, a special set of laboratories was prepared for the FTLcom project. Just as they were getting finished, I put a damper on the job, and now I'm the only one who knows where they are."

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He told Kir Bay how to find the narrow entranceway. "Get everybody down there you can—but do it quietly!"

"What about you?"

"I've got an appointment with a Bloodkeeper. I'll catch up with you later." Sorrel shoved him toward the cart, then ran off in the other direction, toward the Bloodkeep.

There was one Bloodkeeper left who still believed in the FTLcom project, one Bloodkeeper whose bloodline Sorrel had nurtured and protected from the Man-hatred that now exploded through the Rosan culture. Sorrel had talked with the current member of that bloodline earlier that nightspin, though he hadn't talked with him about the dangers of Supremi leadership. Sorrel hoped the two of them could work something out to protect the bloodlines they had so painfully constructed.

As he ran, Sorrel listened on his radio to Daisy's translation of the Rosan newscasts. With a sinking heart, he found that Kir Bay had been wrong; they didn't even have hours before the Supremi took control. There was a revolution in progress, and the elections were being pushed ahead of schedule to select the new Bloodbond.

Sorrel leaned against the wall of the tunnel, panting, wishing he'd learned how to drive the Rosan vehicles even though it was crazy for a human to try to drive down the tunnels—men just didn't have fast enough reflexes for Rosan traffic.

Soon he realized that he wasn't going to make it to the Bloodkeep in time, and he interrupted Daisy's incessant reports on the radcom. "Daisy, is there anything you can hook me with to get through to the Bloodkeep? I need to talk to Mai Toam Let Call."

Sorrel listened as Daisy tried various patches into the Rosan communication systems. Finally they linked to the Bloodkeep, and Mai Toam answered. "Thank God you're there!" Sorrel exclaimed. "Have you been listening to the news?"

"Yes." The Rosan's voice sounded grave. "We face trouble, I fear."

"By the galaxyful," Sorrel muttered. "Listen . . . is it possible to, uh . . . jimmy the labels on people's brainblood?"

Mai Toam coughed politely. "It is flagrantly illegal, Man Everwood." His cough gurgled into a chuckle. "It is not, however, unheard of."

"I see."

Daisy's voice filled the line. "I don't wish to interrupt you, gentlemen, but I've heard some news I believe to be important. The selections are over. The Supremi have given orders to capture everyone involved with the FTLcom project."

It had all happened so swiftly! Sorrel held down the fear in his stomach. "Call Kir Bay and warn him. Tell him I'll meet him at the new labs."

Sorrel rushed down the cavernwork tunnels toward the hidden cavenet, giving orders over his radcom all the way. "Mai Toam, quickly! Switch brainblood nametags on the cannisters for Dor Kat, Tey Fin, and Dor Lee with the nametags for other Rosans—Rosans who're supposed to be loyal to the Supremi. Can your bloodmemories transmit the switches?"

"Probably, Man Everwood, but I'll give you a list for safety. High chance

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says they destroy my brainblood when ledgers show tampered feast labels."

"Oh my god." Sorrel stopped his running, trying to think of an alternative to losing the Keeper's descendants.

"No fear, Man Everwood. Hope is, to switch my brainblood also. You need remember, whereto I'm switched. Prai Kan Tor Loov will be me renewed."

"Good. I'll remember," Sorrel promised, praying he told the truth. He'd have to write that name down at first opportunity. "Kir Bay, have you stashed the equipment?"

"Yes. All's set."

"Great. I'll be there in—" Sorrel leaped to the landing one level lower, turned right, and ran into four younger Rosans. *The Supremi got me*, was Sorrel's first panicky thought.

"Man Everwood, Kir Bay sent us. We return you to your ship swiftly."

"But—"

The radcom spoke; it was Kir Bay again. "All's controlled here, Man Everwood; your advance planning let us prepare with thoroughness and speed. Thank you. Now, you must return to your ship, where you'll be safe for a few generations."

"But—"

The four Rosans were already herding him back the way he had come.

"Where are Cal and Wandra?" Sorrel demanded.

"Good luck, Man Everwood," the radcom answered obliquely. "May you die by a rising star."

One of the four shepherds answered more directly. "Man Minov and Man Furenz return to the ship. You'll see soon." As they rounded another corner, the lead Rosan jumped back, hitting Sorrel in the chest. "Feign death," he commanded.

Sorrel performed as ordered, slumping into their arms. They carried him around the corner, shouted several rapid sentences at someone. More hands grabbed Sorrel, more words, and he heard many people going with him for interminable distances. His arm was being slowly, agonizingly, dislocated from his shoulder by one of his carriers; but he had no time to worry about that; his concentration was focussed on trying not to breathe. He was not very successful.

At last there was a scuffle. "Run!" someone yelled in his ear, and Sorrel twisted to his feet and ran, following the Rosan leader, not daring to look around to see what was happening. The two of them continued to run till they reached the entrance to the outercave, where the ship lay. Five more Rosans pressed there against a long outcropping of stone, along with Cal and Wandra. Wandra held her finger to her lips, gesturing Sorrel to silence. She whispered, "Guards," and pointed over the outcropping. Sorrel nodded.

The six Rosans held a quiet but rapidfire conference, lasting almost a minute, then split in four directions. There was noise from beyond the outcropping, and a portable sonic pulverizer—designed for crushing rocks during excavation—screamed. "Run for the ship!" Sorrel's Rosan yelled above the din. "Good luck!" He ran in front of the three humans into the open stretch by the slagged landing area.

The weapons there could've killed fully armored Rosan larvae, to say nothing of killing delicate humans, but for-

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tunately the guards were busy. Again Sorrel didn't have time to see how they were being distracted—his goggles obstructed his peripheral vision—but the FTLcom team was doing a good job, and only one guard saw the three humans coming. The Rosan leader leaped at him and knocked him down, but in leaping the leader took the tip of a larva-prod in the chest and started to writhe uncontrollably. Wandra screamed; Sorrel pushed her toward the ship's lock as it swept to ground level. Another sonic blaster wailed, and the three humans dived into the lock, which now swept back up into the body of the ship.

All three were shaking and panting. "We've gotta lift off," Cal gasped, heading for the pilot room.

"No," Sorrel said, "don't. Nothing out there will hurt our asteroid armor. It'd take them generations to haul a main tunnel beamer up here from the bottom levels—and if they did that we'd have plenty of warning." Sorrel was still panting, thinking he talked too much. "Daisy," he breathed at the computer, "show us the cavernwork entrance."

"Yes, sir."

Cal and Wandra followed Sorrel into the rec bay; everyone collapsed onto his or her favorite recliner, then looked at the vidscreen's view of the entrance. Several Rosans lay in pools of green jelly, including four of the people who had helped them escape.

"Damn," Cal muttered.

Another party of solemn Rosans, wearing the medallions of the Supremi Elders, came into view, to pour smouldering acid on the brainblood of the traitors, the friends-to-humans.

Wandra clenched her fists in horror. "You bastards!" she screamed into the unhearing viewer.

"Viewer off, Daisy," Sorrel commanded.

"I'll kill 'em," Cal swore, heading for the weapons locker with renewed strength.

Sorrel leaped up, blocking his path. "You'll only get yourself killed."

"Get out of my way," Cal warned, pushing Sorrel hard.

"Stop, you idiot," Sorrel said in exasperation, then hit Cal three times, twice in the stomach, once in the eye.

Caught by surprise, Cal dropped to the floor. By the time he struggled back to his feet Sorrel was snapping a sleep hypo out of his med kit. Cal tried to dodge, but Sorrel winged him with the hypo. "Moron," Cal muttered as his eyeballs rolled up. Sorrel caught him as he fell. "I'll kill the fiends anyway. Wait till I get up."

But by the time Cal returned to consciousness, the fiends, and the followers, and the vanquished friends, had all already died.

Two days later Sorrel called a council of war. They were sitting in the rec bay, weighing possibilities. "Bring in a battleship," was Cal's first, half-serious suggestion.

Sorrel shuddered. "Right. I'm sure the Rosans work every bit as well under compulsion as Men do."

Wandra bit her nails. "Isn't there some way we can talk with the new leaders?"

Sorrel shrugged. "They know how to reach us—the radcom's in perfect shape. I'm afraid, though, that they're not interested. If I didn't know better, I'd guess they'd forgotten us."

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Cal sneered. "What? Forget their God?"

Daisy rang an alert bell. "We have visitors."

Sorrel looked up. "Are they armed?"

"No."

"Then let's see 'em."

The vidscreen brightened, to show a small party of Rosans. The two leaders, carefully facing away from the cavernworks, proudly bore the medallions of FTLcom techs. "Connect us to the external two-way, Daisy," Sorrel said as he rose. "Hello," he waved to the Rosans. "Glad to see somebody finally came around."

Several of the followers looked away, muttering, touching their shoulders with their hands, then sweeping a half-circle, as in the prayers of the Faith of Six Parents. Even the leaders averted their eyes.

One of them spoke. "Men of Earth, my children will remember this moment forever. We apologize for disturbing you."

"Nonsense, my friends." Sorrel smiled, then whispered to Daisy. "Are you sure they're unarmed?"

Yes, Daisy printed on the vidscreen, invisible to the visitors.

"Why don't you two come in?" Sorrel continued.

They swept the prayerful half-circle. "We'd be honored, Man Everwood."

The lock descended to them, and Sorrel sighed. "It's so comfortable in here, those guys would freeze to death. Daisy, you'd better turn up the heat—" Sorrel turned to his companions— "and we'd better check out our coolsuits again."

They were older Rosans, Sorrel realized when they had come inside the ship. "What time is it out there?" he asked.

"Close to dawn, Man Everwood."

Sorrel nodded.

"As you can see, the blood of the FTLcom is weak, yet still lives."

"I hope that that'll soon change?" Sorrel asked. "Else you shouldn't have risked coming here."

"Yes. During nightspin there's still much danger. But the dayspinners never turned as fanatical, though Supremi attitudes abound. We think you could return to MoonBender during dayspin with little risk."

Cal banged the table. "Great. So we can get the project underway again."

The Rosans' petals drooped. "Not quite so easy. Without at least neutrality from nightspin leaders, any dayspin work would be regularly sabotaged. Further, dayspin leaders wouldn't make a commitment without nightspin assent—the nightspin Bloodbond is more powerful, since more people live in nightspin time."

Sorrel muttered. "So we have to get nightspin authority."

"Yes."

Sorrel got up, started pacing around the room. "Tell me. Would they kill me on sight, if I returned during nightspin?"

The two Rosans spoke briefly, then the one replied. "No, we don't think so—the Supremi religion is still rooted, after all, in the Faith of Six Parents, and they must revere you for that. Now that all's calmer, you might be safe. But Man Furenz and Man Minov concern us; their danger would be great."

"Good enough. I'll go convince the Supremi leader—what's his name?"

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"Kip Sur Tel Yan."

"Ah. Take me to him, and we'll have priority 1A again before his blood-feast."

The Rosans gawked. "How?"

Sorrel pursed his lips. "I shall be like a Lazarine unto him," he said grimly. No one understood, and he waved his hands. "Fear not. Kip Sur is putty for my molding. Soon he'll know the FTLcom is the most magnificent weapon the Supremi ever dreamed of." *And Balcyrak will be proud of me*, he thought sourly. He strapped his infrared goggles back into place and departed with the Rosans.

The Bond was old, very old; it was a state Sorrel had seen too many times. But this time that was a good sign. "I have a proposition for you," Sorrel told the Supremi leader.

Rosan facial muscles aren't designed for sneering, Kip Sur gave Sorrel a good imitation. "A weakling from an inferior race brings me a proposition?"

Sorrel drew himself up in anger. "May I remind you that this particular weakling wrought the Faith Of Six from Beyond, to make possible your successes of today?"

The Bond's wide, bright eyes radiated anger. Sorrel continued.

"May I remind you that, though you go soon to meet a rising star, I will remain, to make or break the plans you design today."

That got Kip Sur where it hurt; but Sorrel had to move fast, before Kip Sur's agony turned into even more burning jealousy. "Fear not. You have a chance here to touch eternity, for I can protect and assure your plans, if we come to an agreement."

The agony and depression turned to slyness. "What is your proposition?"

"I intend to help you expand into the Universe, to spread the glory and power of the Supremi across the stars."

"You want me to authorize the continuation of the FTLcom project."

Sorrel was again surprised at the speed of Rosan thought. "I don't think you appreciate the values the FTLcom has to offer the Supremi. There are billions of planets out there, hundreds of intelligent species, and the FTLcom will open them all up for you. Think of it! Always before your people have been trapped on this planet, unable to touch any part of the Universe that didn't reach out to touch you."

The Bond was swept up in a vision of his own. "Of course! Fleets of robot battleships, that we could control from here no matter how far they traveled! At last, to achieve our destiny as conquerors!"

It wasn't exactly the vision Sorrel planned, but it would do. "There's more. With all those conquered species, you'll have plenty of manpower to build colonization ships—ships large enough and stout enough to contain full generations of Rosans, adults and larvae and eggs, so the Supremi could build cities on gentler planets, where growth would not be so slow and painful. Whereas today you can at best fill a handful of cavernworks, tomorrow you could fill hundreds of worlds."

The Bond's slyness now turned to suspicion. "Why would you help us conquer your own people?"

Sorrel frowned. Since he didn't know what kind of a lie to tell, he settled reluctantly on the truth. "The FTLcom

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will enrich your people's lives, Kip Sur, but I don't think it'll do so in the manner you foresee; I believe the desire to conquer will pass, and Man will benefit almost as much as Rosan from our development."

"You doubt that we, with our superior ability, will one day conquer you? Is not victory of the strong inevitable?"

Sorrel shrugged. "We have a testing here, of your future vision against mine—but in both those futures the FTLcom is crucial. I can accept the dangers in your vision, if you can accept the dangers in mine."

The old Bond relaxed on his incline. "Let the visions compete," he said, and rushed to his desk to prepare orders. "Congratulations, Man Everwood; your FTLcom is now a top priority, even higher than before."

Of course, there couldn't be a higher priority than the old FTLcom priority, but Sorrel thanked the Bond anyway; naturally a prioritization made generations ago wouldn't be remembered in the brainblood.

The Bond turned back to Sorrel, teeth bared in a look of pure evil. "But only the visions shall compete, and neither of us will ever know who was right. Guards!"

The adrenalin surged through Sorrel's bloodstream; his heart nearly exploded as he saw his soon-to-be executioners coming. But despite his rising panic, his brain surged with thought as swift as a Rosan's. He searched the room for a means of escape; he saw the Bond with a clarity given only to those walking the edge of death.

Even as Sorrel watched, the Bond seemed to age. Sorrel had known countless Rosans as they aged—far more than any Rosan had ever known—and in his need, Sorrel foresaw to within seconds how long the Bond would live; it was not much. Sorrel waved for help. "Guards!" he echoed the Bond's request, but with much urgency. He jumped half across the desk, grabbing the surprised Bond in a steely grip; the Rosan struggled, but was no match for Sorrel's strength.

Kip Sur shouted orders to the guards, but Sorrel shouted louder and longer. "The Bond's been poisoned! Send for a doctor immediately! Someone get over here and help me get him to the floor—he's writhing, and I'm afraid he'll hurt himself." Just then the Bond did writhe again, and both he and Sorrel crashed to the floor.

The Bond took a deep breath. "Hate," he spat in Sorrel's face, exhaling hard.

His breath was sweet with honeysuckle.

A guard stood uncertainly over them. "What kind of poison?" he asked.

Sorrel struggled to his feet, shaking his head. "I was wrong; call off the medics." Brainblood spread on the floor. "It was just . . . old age."

"You wish me to feast a larva with the blood of Prai Kan Tor Loov?" The Bloodkeeper scowled at Sorrel. "He is a Supremi Keeper, not an FTLcom tech. Why would you want him?"

"Do we have a 1A priority or not?" Sorrel snapped; he'd already bungled this operation, and the longer the Keeper thought about it the more likely he was to deduce the truth. "The FTLcom tech bloodlines have all been destroyed—your ancestors already took care of that.

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We're searching for the closest derivatives of those lines. There are only a few bloods with even brainparent histories of FTLcom blood. The computer searches show Prai Kan to be one such."

The scowl did not ease. "You have no jurisdiction over the blood of Keepers."

Sorrel crossed his arms. "Do I have to go to the Bond and embarrass you? Does our priority not tell you the importance of my presence here?"

The Rosan ground his teeth, then at last signed the papers. "He shall join us in the next generation. May you die by a rising star, Sacred One."

The next day Sorrel returned to the Bloodkeep. He found that a smiling face had replaced the scowling one. "My children will remember this moment, Man Everwood," the new Keeper began. "My name is Col Salm Keer Prai."

"Descendent of Mai Toam Let Call?"

The Rosan's eyes danced with laughter. "Are you a member of the Supremi ruling family? If so, then I am not. If not, then I am so."

Sorrel laughed with the Keeper. "How is your bloodmemory?"

"Keen. I have taken the liberty of arranging a number of bloodfeasts for you already. I trust you'll be surprised at how swiftly my bloodmixes bear techs with good memories for FTLcom work."

"I trust also. But there's other blood even more important that you don't know about." Sorrel told him of the secret FTLcom cavern. "The brainbloods of all the techs who died in the labs should still be there. We'll truly have a Renaissance, if you can somehow return their bloods to the system."

Col Salm pondered a moment. "Difficult, but worthy. It shall be done." He looked at Sorrel with the too-common awe of a child. "You've performed a miracle, saving so many of our people."

"Umph." Sorrel still chastised himself for not having done better, but then, it was also true that no Rosan could have done as well. "Yes, the techs have been saved. I just wish I knew what to do about the Supremi, whom I would like not to see saved."

Col Salm's petals waved in agreement. "How sad there are no more politicians or theologians like Prim Sol Mem Brite."

Sorrel looked away. "Yes. Or even like Or Sae Hi Tor." A puzzled thought overtook him. "That reminds me of something I've wondered about for a long time. What ever happened to the brainblood of Prim Sol Mem Brite? I would have expected all the political bloodlines to trace back to the First Disciple of the Faith of Six."

"Didn't you know the fate of the first carrier of your Gospel?" The Rosan must have been stunned by such ignorance; Sorrel blushed furiously. "I'm sorry to be the bearer of these age-old tidings. There was much turmoil in the wake of Prim Sol's revelations. The labels in the bloodkeeps were all either destroyed or switched, by either supporters of the Great Faith or by the traitors who still supported the Faith of Four. The Disciple's brainblood was lost amid the chaos, as were all other people's."

"Couldn't you trace his lineage after the fact? Surely anyone who had him

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as a blood- or brainparent would remember, at least for a few generations."

"Oh yes, many people claimed him as ancestor—far more than any being's brainblood could give feast for." He waved his petals in futility. "They say our newer computers could trace back to him, and then back again to modern times, but it would be the work of generations. Several efforts have been made in the past. They failed, long before it even could be determined whether success was possible." His petals pulsed in sorrow. "And if found, what value would it produce? His memories are ages too remote to be found again—even the best memories could not bring him back."

"They couldn't, huh?" Sorrel clapped his hands in joy. "My friend, I think you've just ended our troubles. Thank you." He was quite sure he left the good Keeper quite mystified.

Sorrel was whistling when he barged into Wandra's room on board the ship. "I'm canceling all your lectures for the next few days," he said.

"What?" Wandra whirled away from her dresser to face him. "Who would I be lecturing anyway?"

Sorrel told her about the techs who would soon receive incarnations. "But that's not the best news, and that's why you won't start teaching yet."

"What could be better?"

Sorrel pulled out a grease pencil and scribbled on the wall.

"Hey! Stop that!" Wandra tried to pull him away, but he laughed and finished his writing. PRIM SOL MEM BRITE RETURNS, the scribble said.

"I've started putting a few inscriptions like this here and there throughout MoonBender. So the natives can get used to the idea."

"Have you completely lost your mind? What are you doing?"

"I'm bringing the Faith back to Khayyam. And you and me, lady, we're gonna bring the Disciple himself back to do it!" Sorrel told her about the great politician/theologian who so many years ago first translated Sorrel's dissertation into the Faith of Six Parents. "So your task, my lady, is to hop onto that computer and find his descendants."

She shook her head, dazed. "Would you calm down? You're still moving too fast for me. What good will it do to find his descendants? They don't remember anything about him, do they? To say nothing of being like him."

Sorrel rubbed his hands together. "True, my lady, true. And even the best Rosan memorists can't bring back memories more than a handful of generations old." He pointed to himself. "But this ain't no Rosan memorist here." His voice turned grim. "No, I'm no Rosan. I'm almost an immortal. And just this once, that 'almost' will be enough."

It took many days to find a bloodline with a high probability of tracing from the Disciple; and that was just the beginning. "So we believe you are his descendent," Sorrel told the Rosan who had been chosen by fate and technology. "We want to hypnotize you and do a complete memorist retrogression to find his memories."

The Rosan puffed up with pride in his heritage. "I'd love to have his memories," he said dreamily. "Can you do it? I didn't know you could retromemorize that far."

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Sorrel grimaced. "Well, you've hit on the problem. You see, we can do it—but you'll never know. If you agree to memorist hypnosis, you'll spend the rest of your life here in trance. Then we'll do the same with your children, and their children, and finally some generation we will find out whether the computers were right, whether the Disciple is the founder of your family."

The dreamy look fell from the Rosan's face for a moment. "It must be very important."

"More so than I can explain."

The Rosan sighed. "What nobler cause could there be, than to give one's life to reunite the Writer of the Gospel with his Disciple, the Parent with his Child? Let us begin."

So they began. Layer after layer of Rosan personalities peeled back before Sorrel's patient yet relentless questing. But each peeling brought him to two bloodparents, two predecessors, and two more possible paths to Prim Sol. Soon Sorrel could no longer peel back through all the parents; he and Wandra were reduced to eking out clues from the Rosan computers and the Rosan minds. With those clues, they fought and considered and guessed and, finally, selected the paths to search.

And the helpful Rosan's children came to them, and stayed, and grew old, and died. Though the Rosans came freely, and rarely complained of their loss, yet with each child and with each child's child the burden of Sorrel's guilt grew. Each day Sorrel cursed himself for a fool; had he known truly the price of the search before beginning, he would not have started, he would say, and Wandra would tap her foot and tell him he was full of it, and soothe him and convince him that it was too late to turn back, that they should not waste the lives of the Rosans who volunteered to help.

And finally they reached back into the time of the Revelation, and a dying Rosan opened his eyes with surprise to tell them, "I remember."

Sorrel paced back and forth in front of the larval Keep.

"You look like an expectant father," Wandra chastised him.

"I suppose in a sense I *am* a father," he replied. "In some sense, he is my creation—both in that earlier time when he rose because of my work, and now because this Rosan remembers his memories because of my efforts." He stopped his pacing. He muttered, "Perhaps together we can do enough good to compensate these people for the wrongs we caused separately."

Wandra snorted. "He certainly ought to be able to do something—with the blood of Or Sae Hi Tor, Dor Laff Toa Linn, Prim Sol Mem Brite, and Sor Lai Don Shee in his mind. Sor Hi Laf Brite should have a medallion with the emblem of Superman on it."

The gate opened, and a newborn Rosan stepped out. Sorrel looked at him with concern; he seemed thin for a Rosan just out of bloodfeast. Would his life be even shorter than normal?

"Sor Hi?" Wandra stepped up to the young being.

"Yes," he said, "You must be Man Furenz." He turned to Sorrel. His voice turned reverent. "And you must be Man Everwood." He stepped forward hesitantly. "Prim Sol always hoped that one

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day one of his descendants would meet you; I remember, and his memory knows great joy this day." He held out his hand, and the petals of his forearm caressed Sorrel's forearm.

Sorrel choked. "So do I. I'm glad you're here."

Abruptly Sor Hi stepped back, saw people waiting for him. "I must go; the dusking teachers wait for me." He strode off. "I'll see you again soon."

"We should be teaching him," Sorrel grumbled as he and Wandra walked off.

"Like hell. You want to slow him down that much?"

Sorrel didn't say anything.

Wandra giggled. "I think we should doublecheck over arrangements with the prophecies and legends, to make sure everybody finds out that Sor Hi is the one who's been promised." She threw her head back in laughter. From time to time, in the moments when they most needed release from grief over the retromemory treatments of Prim Sol's family, Wandra and Sorrel had traveled through the cavernwork sowing legends. They would tell Rosans of the visions their ancestors had had of the Disciple's return, and speak of omens and portents. Later they found new stories spreading, stories that they hadn't started, and when asked for verification they would give it, thus expanding on someone else's fabrication. The populace was ripe for a Return.

Sorrel chuckled. "Don't worry about people finding out that Sor Hi's the one—the techs have found some advertisers who're just delighted to sell this product. The advertisers, you see, are Believers."

"Wonderful." Wandra rested her head on Sorrel's shoulder.

A group of Rosans hurried by, and Sor Hi was among them. "How's it going?" Sorrel yelled to him.

Sor Hi paused. "It's wonderful. Prim Sol's memories are of the sorrow and hatred between the bloodlines who fought during the Revelation. He knew only of the anger and obstinacy that opposed him. But for me it's different—this time, I am as much a hero as the Disciple was a villain." He breathed deep, then looked at Sorrel. "It is a wonderful world that you and he created," he ended.

Wandra agreed. "Yes, it is."

Sorrel watched him disappear into another passage. "I wish there were something we could do for him."

"There is."

Sorrel looked down at her. "What?"

"Get some sleep, so we can be available later, if he needs us." She snuggled against his arm. "Or maybe do something else. I think we should celebrate. Can I seduce you?"

Sorrel smiled at her. "I'm afraid you may." They headed for the ship. "Let's find out."

Sorrel and Wandra found the FTLcom laboratories almost vacant; what few Rosans were there were busy at communication consoles, not FTL prototypes. Cal sat in the one chair in the room—specifically provided for the humans—with a look of bewilderment.

"I don't know whether to laugh or cry," he sighed. "Sor Hi was here for about six hours, studying our problems. Wandra, did you know we were ditching the hyperspace rotational method because nobody could figure out how to

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control the timing?"

Wandra nodded.

"Well, at the end of six hours, Sor Hi just looked at it and asked why we couldn't do it one way rather than another, and the solution was obvious." Cal turned to Sorrel. "What this means to you is that we should have an operational FTLcom in just a few days."

Sorrel's jaw dropped open; Wandra jumped up and down and clapped, and hugged both Cal and Sorrel. "Congratulations to all of us!" she exclaimed.

"Yeah," Cal said sourly. "That is, we should have one operational if anyone ever goes back to work. Unfortunately, everybody here's gone bonkers. They can't think of anything except the upcoming Bloodbond election."

Wandra clapped some more. "That's fine, Cal. Who's winning?"

"Who else? The finest mathematical physicist in the universe. The Supremi incumbent doesn't have a chance, unless he can stall the election until Sor Hi is dead."

From his coolsuit Sorrel unhitched his comlink to Daisy. "Well, since everybody else is caught up in the election, we might as well be too."

They listened to the reports. This time it was with more pleasure than Sorrel had felt the last time politics interfered with work, when the Supremi ascended to leadership.

From time to time Sor Hi would return, say polite words to Sorrel and the rest of the humans, then launch into vibrant discussions with his advisors. Each time he returned he was more confident, more mature, more capable. Once the broadcasts told of an assassination attempt on him, but even as Sorrel's hands grew clammy, Sor Hi came bursting into the cavern, reassuring them he was all right. "If nobody tries to kill you, then nobody's taking you seriously," he explained cheerfully. "At last I know that people are interested."

"I want to help him," Sorrel muttered as Sor Hi burst off again in a whirlwind of activity.

"I know. You've said it before. Nobody's going to pay any attention to you," Wandra replied.

Four hours later, Sor Hi returned again. He dismissed his advisors to talk to the humans. "Would you like to be with me in the Hall of Choosing? I would be honored by your presence when the vote is taken."

No offworlder, Sorrel knew, had ever attended a Rosan election. "Thank you," Sorrel said. "We'd be honored as well."

Two two-story platforms rose out of the sea of Rosan faces there in the Hall—an awesome cavern, with as much space as the largest of human spacedomes. On the lower level of each platform the most important advisors of each candidate stood, answering detailed questions for the media, and on the higher level stood each candidate himself, describing his plans, hopes, and dreams, pulling his audience into those dreams and making those dreams their own. The room was filled with talking, listening, reading, and watching, all of which had an intensity that Sorrel had never imagined. Wandra leaned over to him. "You know, you can almost see the information in this room; you can see the knowledge being transmitted in wave after wave."

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... nodded.

... suddenly a hush fell; the voting began at counting booths scattered throughout the Hall.

Then it was over; the loudspeakers announced Sor Hi's victory. An awesome cheer began and ended; Sor Hi gave his inauguration address. It lasted a full minute and a half. A second cheer began—but the noise of a violent explosion shattered the joy. The vibration threw Sorrel to the floor, but he leaped up again even as he realized he was falling. He ran to catch the tumbling body of the new Bloodbond, Sor Hi.

Muscles tore and his back wrenched as Sorrel caught Sor Hi in his arms. Together they fell back to the platform, with Sorrel twisting to protect Sor Hi as much as possible.

Sorrel groaned and rolled over. A Rosan with the medic's medallion leaned over Sor Hi. "He's alive," the medic announced. Sorrel sighed, rolled over again, winced at the new pain in his back, and fell into unconsciousness.

When he rolled over again, he found himself in a comfortable bed; his own bed on the ship. He heard the high-pitched, hummingbird sound of a Rosan chuckling, and opened his eyes to look toward the sound.

Sor Hi lay propped in a cot, looking back at him. "Thank you, Parent. And congratulations. We have won."

"What happened?"

"Another assassination attempt. This one succeeded, but not well enough. I have lived long enough. The Supremi bloodlines have been ordered diluted. And they have no immortal beings to protect their dreams from my orders, as I have you to protect mine."

Sorrel looked at the wounds and bandages covering Sor Hi's body. Yes, the assassins had succeeded all too truly. A wounded Rosan had little time left—his body would burn its layers of stored nutrient in a furious attempt to repair the damage, leading to swift death by starvation.

Sorrel rose slowly and painfully from the bed. "Can I get you anything?"

Sor Hi's eyes drifted absently around the room. "No. I am happy here."

Sorrel searched Sor Hi's face with growing acuteness; the thickness was lifting from Sorrel's mind. Sor Hi's skin was drawn tight against his cheeks; death approached.

" 'May you die by a rising star'," Sor Hi muttered. "Isn't it funny? Ever since we went into the caves, no one has ever died by a rising star. I wonder what it would be like."

With a horrified sense of awe and wonder, Sorrel looked at his watch. He found what he had somehow already known: the sunrise was coming. "Follow me," he told Sor Hi, "I have something to show you."

The top of the ship peeked out from the cavernworks; there Sorrel and Sor Hi found a view of Khayyam in the morning. Now the sun too peeked out from the horizon, and touched the shallow pools of water dotting Khayyam's surface. In that fiery touch the warm water quivered, and bubbled, and broke into boiling. Clouds of steam rose into the purplish sky, condensing into rain as it rose, falling, and boiling again into steam as it neared the surface. Frenzied rainbows danced across those spinning almost-rainstorms, only to disappear as

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the rains evaporated until the next sunrise.

Sor Hi exhaled sharply. "It is incomparable," he whispered in awe. "My children must remember this beauty for me." He looked at Sorrel. "And they must remember you too." He drew a last hard breath. "I . . ." The surprise of sudden insight entered his eyes. "It's even harder for you," he said. "You . . . must keep on living."

Sorrel sobbed. "Yes, my son." The honeysuckle overtook them, each in its own way.

They found Sorrel there in the nose of the ship, and moved him gently to his own room. For three days he lay there, not speaking, not eating, not moving. He was aware of people when they came to him, he heard them when they spoke, he felt them as they hooked the feeder to him, but he did not care. Deep in its own quiet his mind waited, waited for something to trigger it back to life. Sorrel didn't know what he waited for, and about that, too, he did not care.

On the fourth day they told him the FTLcom was ready. Now they could project a three-dimensional image to Lazara and get one back in return. They told him they were about to make contact with Balcyrak.

It was the trigger his mind awaited. He looked up at them, then rose and followed them to the FTL lab.

Balcyrak studied him quietly, smiling gently. "Do you still hate us, Man Everwood?"

Sorrel looked down, shook his head. "No. I have walked in your shoes."

"Yes. It is not easy, to be a Lazarine."

Sorrel started to speak, choked, shook his head.

Balcyrak continued. "I want to thank you for all you have done for us. My whole race thanks you, and our civilization shall sing of you, our savior."

Sorrel stared at Balcyrak for a moment, then realized what he meant. Balcyrak had lied earlier. There had been no question of who would win the next Lazaran/Man war, had one occurred. Sorrel had saved the beings who had killed his wife; he did not mind. "I'm glad." He felt weary. "By the way, Balcyrak, there's something I'm curious about—how old are you?"

Balcyrak relaxed in his chair. "Nearly 14 millennia, I would reckon, by your measure."

Sorrel pondered that. "Just about entering middle age, for someone who lives 25,000 years."

"Yes."

Sorrel sighed. "It would be wonderful, to be almost immortal like you."

Balcyrak sat up, looked sharply at him and through him, as Sorrel started to smile. Balcyrak saw the smile and chuckled. "Yes, almost immortal."

Together they started to laugh, a rich powerful laughter that even the dark universe could not deny. ■

● Only a mediocre person is always at his best.

W. Somerset Maugham

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RUBBER SHEET PHYSICS

Tim Poston & Ian Stewart

A funny thing happened on the way to modern mathematical physics. The mathematics took a fifty-year detour.

Last century, people still thought that Newton's description of the solar system was a Final Truth. The sun and planets formed a kind of infinitely accurate clock, set going when the planets were hurled by the hand of creation. By the nature of its mechanisms, it could not run down.

Could it, however, run wild?

For instance, could the other planets resonate with the Earth like a child's legs "pumping" a swing, so that the Earth collided with Mars, or ran off into the cold and empty interstellar wastes?

One can write down special "solar systems," simpler than ours, for which this happens.

Could it happen to *us?*

In 1887 King Oscar II of Sweden offered a prize of 2500 crowns (on the order of $20,000 in today's money) for an answer to this question.

Existing methods were far from adequate. They gave an exact solution, valid for all time, to the problem of *two* bodies moving under mutual gravitation: the bodies follow Kepler's ellipses, at the speeds Kepler laid down before Newton. Forever.

For *three* bodies, only a few special solutions were known; for more than three, even less. In the 18th century Joseph-Louis Lagrange discovered some particularly important ones. (The group backing Gerard O'Neill's plan to colonize space using such orbits is the L5 Society: the *L* stands for *Lagrange*.) Together with the Marquis Pierre-Simon de Laplace, he showed that the total departure from circularity of all the planetary orbits, added up, was constant—and that total was too small, even if concentrated on the Earth, to switch it to a cometary orbit.

But this did not show, for instance, that the Earth's orbit could not slowly gain energy from the others, and drift

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out by bigger and bigger almost-circles, until we were lost in the silence and the dark. Proof was still lacking that we would neither leave the hearth nor fall into the fire, and for this the king offered his crowns.

Henri Poincaré, "the Last Universalist," attacked the problem. To do it, he invented the tool of *topology*, first known as *analysis situs*. Both Latin and Greek have the same opaque translation: *the study of position*. This is often called "rubber sheet geometry," because it concerns not *lengths*, but *shapes*, in a flexible sense.

To see how it enters, suppose that we somehow knew that the positions and speeds of all the planets would again be exactly as they are now in—say—seven hundred and thirty thousand and forty-two years, eighty-three days, and twelve hundred seconds. Newton's Laws would then imply that they would repeat the same set of motions again. And again . . . If the path, in the space of all possible positions and speeds, that the planets follow is a *closed* loop —joining up with itself—then the question is answered. No planet can ever wander off; the system is "periodic," repeating the same motions over and over again forever.

We thus see the importance of questions like "Do paths in position-and-velocity space close up?". Poincaré's contribution was the development of ways to attack such questions *directly*, without first calculating the numbers (like 730,042 years) that might be involved. He initiated the direct treatment of topological properties: those unaltered by deformations that do not rip or tear.

He did not settle the stability of the Newtonian solar system: that had to wait until the 1960s. But he made such a dent in the question that in 1889 he was awarded King Oscar's prize, and most thoroughly deserved it. He had invented a whole new powerful kind of mathematics. He showed how to reduce various types of physical problems to topology, and in some cases solved the topological problems that arose. For instance, he proved that in the three-body problem there are infinitely many distinct periodic motions, provided that a certain theorem in topology is true. In 1913, the year after Poincaré died, the American mathematician George Birkhoff proved the theorem.

However, after this impressive beginning, topology rather faded from the view of the scientific public. This happened because, as the history of Birkhoff's theorem illustrates, topological problems are *not* always easy to solve. Because it was so difficult to solve the topological problems posed by physics, mathematicians were unable to act as short-order cooks for the physicists, with the motto "bring us your question in topological form and we'll tell you the answer." Even if most physicists had known enough topology to recognize a possible reduction to topological form. Further, the increasing complexity of physics and mathematics made it virtually impossible to do both well: Poincaré was perhaps the last to be a great physicist *and* mathematician.

So the topologists had to keep chewing away at the topological problems

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Poincaré had found, and the problems these in turn could reduce to, and the problems that came when you generalized the ideas involved, or invented new tools . . . It all got far removed, apparently, from physics.

It *had* to.

When a mathematical question from physics can be solved quickly with existing tools, a physicist *as* a physicist can learn these tools when he needs them for his problem. When it takes years, or generations, only interest in the *mathematics* can keep him at it. So he turns away to other, more tractable, physics; or replaces the problem with a rough approximation; or he becomes a "pure" mathematician whose attention is focussed on the mathematical problem and not on its application.

Topology thus turned inward on itself, to solve its internal problems, to set its own house in order. From the outside, this looked as relevant to the price of fish as the sage Gautama sitting cross-legged under a tree, meditating on the nature of suffering. How could such inward-looking effort lead to history's only pacifist empire, three hundred years later? To non-specialists, topology's introspection could appear to border on the psychotic. For example, Aleksandr Solzhenitsyn had enough mathematical training (Rostov University 1936-8) to recognize the self-absorption, but not enough sense of history to see the reasons for it, when he wrote in *The First Circle*:

"Nerzhin, his lips tightly drawn, was inattentive to the point of rudeness: he did not even bother to ask what exactly Verenyov had written about this arid branch of mathematics in which he himself had done a little work for one of his courses. Suddenly he felt sorry for Verenyov. Topology belonged to the stratosphere of human thought. It might conceivably turn out to be of some use in the twenty-fourth century, but for the time being . . .

'I care not for the sun and the stars,
I see but man in torment.' "

In fact, just as its temporary abstraction was inevitable, so was its return to application—once enough internal problems had been solved—and much earlier than the modern prophet of Mother Russia predicted.

Topology is the fastest-rising star in the mathematical heavens. Roughly *one third* of all mathematical research involves topology, and there are as many mathematicians in the world as economists, and far more than astronomers. That represents a tremendous research effort of which the non-specialist is almost totally unaware.

One consequence of topology looking down at its own navel for so long (and what subject is better fitted to do this?) was that, in the meantime, physics changed. Newton's gravitational theory came to be seen as a first approximation to Einstein's—so anything exactly proved about Newton's solar system need *not* be true about Einstein's. And the question "Does it ever run wild?" involves *infinite* time, which can magnify subtle differences and completely change the answer. And anyway, atomic theory says that the sun will blow up, making the future of planetary motion about a sun moot.

Thus the problems which originally provoked the creation of topology are

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no longer fundamental physics. But topology, now a powerful machine, *is* being applied to fundamental physics—as we shall see.

How can this be?

It is being successful precisely *because* it forgot the details of those primeval problems, and concentrated on the deep structure they concealed. This deep structure is inherently tied to any mathematical scheme that makes use of continuous variables (not just taking integer values 1, 2, 3 . . . but also the numbers between). Thus it *must* turn up whenever such a scheme is used in the sciences—though whether its presence helps depends on the questions you ask.

To illustrate this depth of topology, and the way that it touches not just many things, but many *kinds* of things at their roots, consider one of its minor theorems, famous for its reasonably exact non-technical expression: "It is impossible to comb a hairy ball smooth." Here are three of the things it can be used to prove.

(1) At this moment, there is at least one point on the Earth's surface where the horizontal windspeed is zero. (Proof: If not, comb the hairs on the ball in the direction of the wind at corresponding points on the Earth.)

(2) A spherical magnetic "bottle" for plasma, as used in 1950s fusion reactor experiments, must leak. (Proof: It leaks where field lines run straight in or out, not flat to the surface—and there must be such points.) Modern reactors use donut-shaped bottles, which *can* be combed.

(3) The "Fundamental Theorem of Algebra": Every polynomial equation has a solution in complex numbers. (Proof: Technical, but based on the fact that the complex numbers, plus a point at infinity, form a spherical surface.)

Notice that (2) is about nuclear engineering—but the theorem comes directly from Poincaré's work on planets, done when the idea of "atoms" was a hotly disputed theory supported mainly by chemists. The variety of the ways that the theorem can be used, and the somewhat unexpected conclusions, demonstrate the profundity of the ideas involved.

In the rest of this article, we shall outline *some* of the ways that topology is becoming involved with scientific research. Of course, we have space only to scratch the surface, but we hope the scratches will release some of the flavor.

Solitons

A new kind of wave is fashionable in physics, one that looks very like a particle.

You doubtless know that quantum theory has electrons looking like waves for some purposes, particles for others; but this idea is different. There are examples in both classical *and* quantum physics. The first one recorded was a water-wave in a canal, followed by Scott Russell on horseback for two miles in 1834; the new interest in them comes from their relation to some of the newest and deepest "second quantized" theories of space, time, and matter. Here we can only introduce them.

A solitary wave, or *soliton*, has two key features: it is more or less localized, and it *does not disperse*. It stays localized, perhaps moving along, but without smearing out into a less concentrated

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mixture of ripples with different frequencies and speeds.

Now, think of a row of pendula, closely coupled with elastic (Fig. 1). To make a pendulum point upwards, we must input energy to counteract gravity; but to make one take a position differing from its neighbors we must also input enough energy to stretch the elastic. Even if we allow the elastic to pass through the long axle, it won't stretch far enough to let neighboring pendula point opposite ways. So the "kink" in Fig. 1 cannot come undone—though it can move along the axle. The distance over which pendula point upwards can't increase much, either: what could hold a whole *row* of them at the top? The kink is a soliton.

This mechanical model exemplifies a "one-dimensional field theory." For each point on the axle AB (one-dimensional space), the "field variable" measuring position of the pendulum takes a particular value. Here the values are angles, that is, points on a circle. In a general field theory, both the space over which the system sits, and the space of field variables, may take different topological forms.

One soliton can't come undone: in this respect it resembles a particle. Two *opposite* kinks can meet and destroy each other, releasing energy (potential

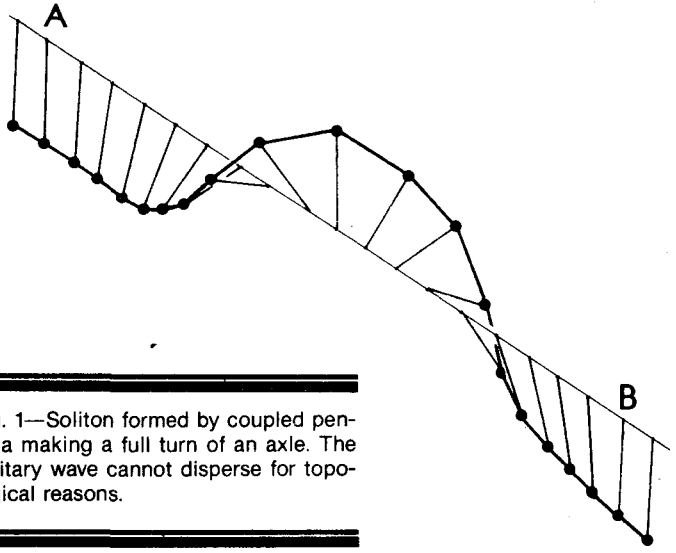

Fig. 1—Soliton formed by coupled pendula making a full turn of an axle. The solitary wave cannot disperse for topological reasons.

and elastic): read Fig. 2 downwards. Or an input of energy can *create* a soliton and an antisoliton, which move apart: read Fig. 2 upwards. This is reminiscent of particles and antiparticles. There are other similarities: a crucial early discovery was that soliton solutions of the "Korteweg-de Vries Equation" collide, interact, and separate again, very like particles. Fig. 3 shows such a collision

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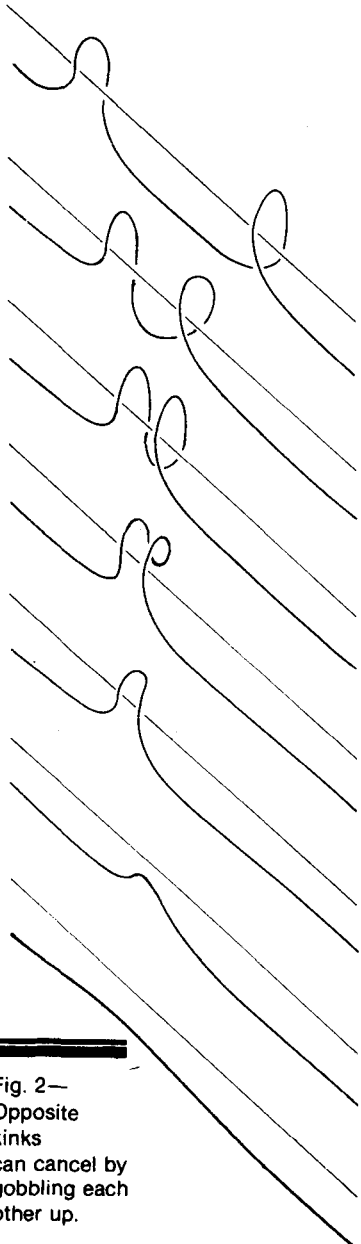

Fig. 2—Opposite kinks can cancel by gobbling each other up.

for the similar "sine-Gordon Equation," where the solitons are two-humped: think of the curves as successive frames in a movie, viewed from front to back to simulate motion.

Back to kinks. The number of turns in a kink, counted positive in one direction, negative in the other, is called its *topological charge* by physicists, because it behaves so much like the traditional electric charge on electrons and their antiparticles. Now, the number of turns may be a topological concept, but it does not take a topologist to compute it. However, there are more complicated cases. For instance, suppose there is a *sphere's* worth of positions for each pendulum, not just a *circle*.

Any loop on a sphere can be shrunk down to nothing (like the kink + anti-kink of Fig. 2, or an elastic band on an orange). So for spherical states over one dimension we *can't* get solitons.

But suppose we have not a *line* of circles or spheres, but a *plane* of them. Instead of a loop, we must wrap a piece of *surface* around. What happens?

For circles, we again get no isolated solitons.

But for spheres, we *can* wrap a square on in an unremovable way. Think of a beach-ball in a bag made by pulling tight a drawstring round the edge of a square cloth. In fact we can wrap once, twice . . . get opposite wrappings to cancel . . . just like kinks. This is harder to visualize, though; the bag must be allowed to pass through itself. Imagine a line drawn from the top edge of the bag, down the front, and up the back to the far edge. Wrap *that* round the equator of the ball the required number of times before pulling the string! In

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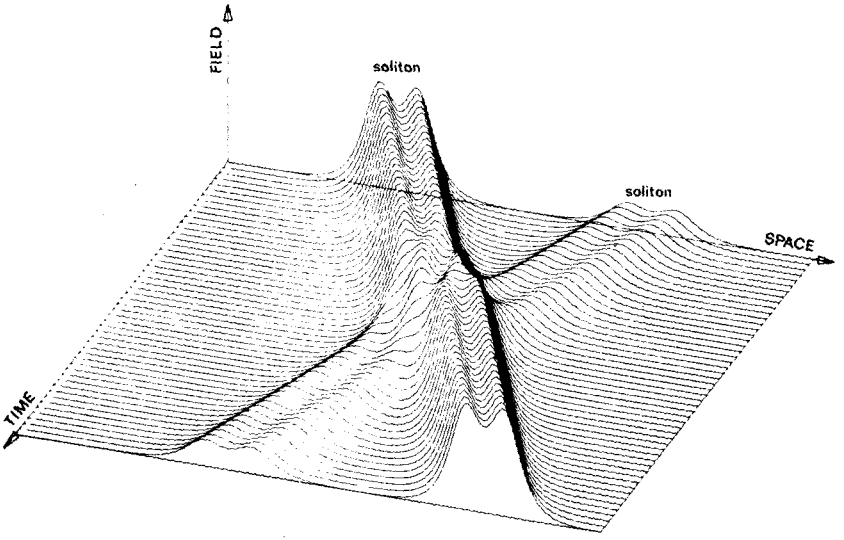

Fig. 3—Soliton collisions mimic those of fundamental particles. After a complicated interaction the solitons separate (usually with a phase shift) and regain their individual identities. Source: R.K. Bullough and P.H. Caudrey, *The multiple sine-Gordon equations in non-linear optics and in liquid ^{3}He*; in F. Calogero (ed.), *Nonlinear evolution equations solvable by the spectral transform.*

fact, it's easier to see if you use two beach balls, divided into segments like oranges. Wrap the second ball over the first so that the "poles" coincide, but each segment doubles in width round the equator, or trebles, etc. The way the equators wrap (just like kinks) determines the way the balls wrap. Topological charge again takes whole number values . . . −2, −1, 0, 1, 2, 3 . . .

It may seem that everything depends just on the space and the field variable dimensions, and that charge is always just a number. But it's richer than that.

Suppose, instead of "pendulum position" in Figure 1, we specify a particular rotation (for each point on the axle AB) about an axis at right angles to AB. The set of such rotations is two-dimensional, like a spherical surface, but it contains loops that *cannot* shrink to nothing. However, *any two will cancel*, so topological charge can take only values 0 or 1, with $1+1 = 0$. To explain this surprising fact properly would take a whole article on the mathematical theory of "homotopy groups," which —we *now* know—define the possibility of solitons, and the arithmetic of topological charge, for any topological situation. They were not introduced for this reason, however: their study was initiated by Poincaré for purely mathematical purposes. It is likely that all the

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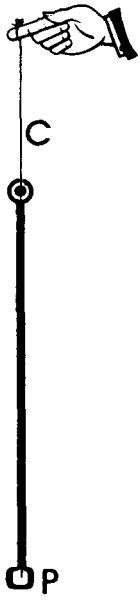
cases that will ever interest a physicist had already been computed before any topologist had heard of solitons.

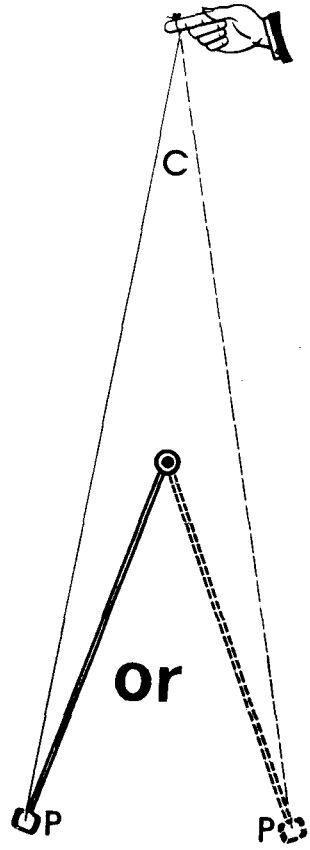
Catastrophes

Take just one pendulum, and fix a long elastic thread to the bob. Pull the free end slowly upwards (Fig. 4): until a certain height, the pendulum hangs straight down. Suddenly, it starts to move to one side.

What has happened is that "vertically down" is no longer a position with minimum energy. As Fig. 5 shows, it suddenly becomes (locally) an energy *maximum*, and two new minima appear from nothing. The pendulum sits in one of these new positions.

Fig. 4—With the elastic C barely stretched, the pendulum P still hangs down. When C is pulled higher, P hangs to one side.





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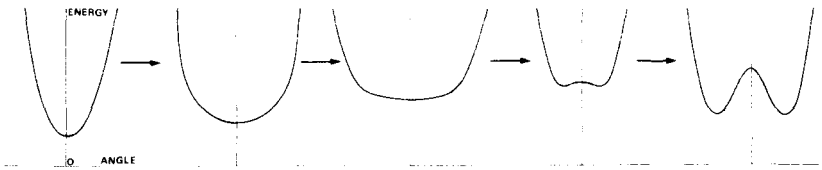

Fig. 5—What happens to the graph of elastic potential energy against position of the pendulum, as the hand moves upward.

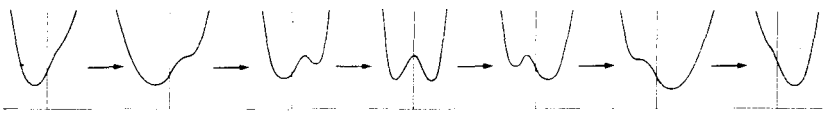

Fig. 6—What happens to the graph as the hand moves from left to right, high up.

Moving the free end from side to side at this height changes the energy graph as in Fig. 6. When the end is in left field, we are simply pulling the bob to the left, and there is no equilibrium position to the right. But as we move across, a right-hand equilibrium appears: later, the left-hand one vanishes and the bob hangs to the right.

At no stage is "straight down" a minimum energy point, so the bob cannot sit there. But it *crosses* this position, so it has to *jump* across it, out of equilibrium. Try it and see: the jump is quite dramatic.

Here, the change in the topological "shape" of the energy graph (the number and arrangement of maxima and minima, which looks the same if, say, we stretch the axes) shows up as a forced jump of the physical situation, known as a *catastrophe*. (This word, chosen in French to suggest suddenness, does not in this context imply "disaster." Indeed, since there are promising applications of catastrophe theory to normal embryo growth, a "catastrophe" can be necessary and desirable.)

Graphs like Figs. 5 and 6 can have many meanings: graphs of energy, of time taken to do something, of profit and loss, of probability, of a fluid "stream function" . . . In each case the relation with physics, or some other science, differs. But in each case the change in topology of the graph "organizes" some of the most important changes in the behavior of what the scientist is describing.

Like their classification of solitons before hearing of them, topologists found they could classify such changes of shape in advance of knowing about any particular application. The great in-

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sight here—though many other people were vital to its development—was that of the French topologist René Thom. He saw that in "typical" cases the way that the shape changed *did not depend on how many variables the graph involved.*

With at most four dimensions of control, the shape of the graph within a small region typically changes in only one of seven ways, named *elementary catastrophes* by Thom.

Early popularizations of catastrophe theory, from about 1970, set some people charging around proclaiming that every discontinuity in Nature was one of Thom's seven. They were wrong, for two main reasons. First, not every jump in Nature is governed by the changes in a graph. Second, "typicality" is a strong property, but not absolute. The atypical *may* happen, or may be forced by additional constraints.

Solid and testable predictions from the theory began in earnest only in the second half of the 1970s, mostly in the physical sciences (where over half the published applications occur). We have described some of these—to ship stability, elastic buckling, lasers, fluid flow, ecology . . . plus some more tentative ones, in *Catastrophe Theory and its Applications* (Pitman, California and London 1978). If it were written now it would be easy to double the length. Here we illustrate the theory's strengths in a physical setting where typicality arguments may be used with precision: light-scattering by irregular droplets (such as rainwater on your eyeglasses).

Fermat's Principle, an ancient optical discovery, says that light travels in paths taking shortest time. Strictly this should be "stationary" time, not shortest: the mathematics takes this into account. We get a "graph" of the time value against the space of all possible paths leading to a given point. As the point is moved around, the graph changes. Where the *shape* of the graph changes, many light rays pass close to the chosen point, and we get a *caustic*: a region of exceptional brightness. The rainbow, and the bright curve often seen in a coffee-cup on a sunny day, are examples of caustics.

Catastrophe theory, which tells us about such changes in shape, predicts that for a typical, *irregular* droplet, these bright points come in exactly five types. (The points are in three-dimensional space, which excludes two of Thom's seven.) The general droplet is far too complicated for direct calculation: the standard textbook calculations work only for symmetrical droplets, which are special, atypical, and give different caustics. But its very generality limits its caustics to five local forms. Fig. 7 shows a slice of the diffraction pattern associated with one of these forms, drawn by Francis Wright using a computer, compared with an experimental photograph made by shining a laser through an uneven drop.

Thom's work has made possible a shift of attention from the impossibly special *ideal* case, approximated by carefully ground optical instruments, to the typical *real* case found in Nature. Read the recent papers on this in the journals of the Royal Society, by Berry, Nye, Upstill, Wright. . . . You will look at street lamps on a rainy night (viewed through window or eyeglasses) with a new vision, and see more than you ever did before. Light dancing on the bottom of a swimming-pool, stars

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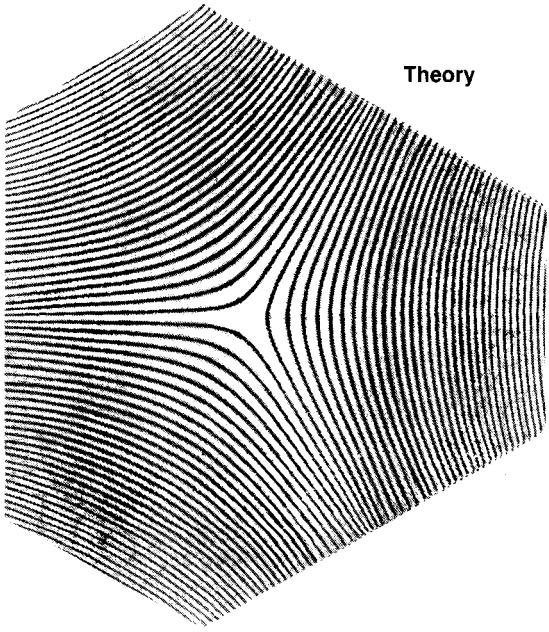
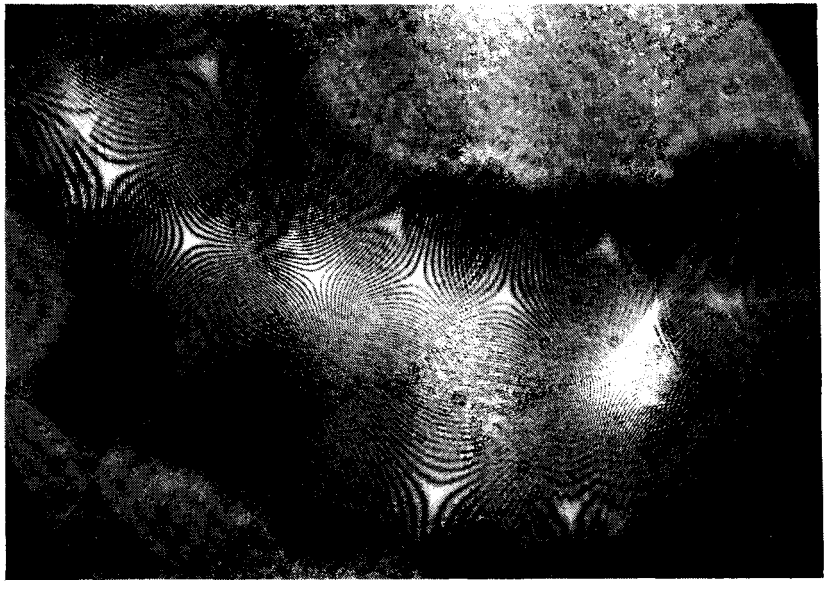


Fig. 7—Experiment shows, many times over, the local structure that theory predicts. Source: M.V. Berry, J. Nye, and F. Wright, *Philosophical Transactions of the Royal Society 291*, April 1979; J. Nye, *Proceedings of the Royal Society 361*, 1978.

Experiment



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twinkling, sunlight glinting on the distant waves . . . all are organized by these changes of topological shape, the "elementary catastrophes."

Chaos

In the heyday of Newton's mechanics as Final Truth, Laplace claimed that if we knew the exact position and velocity of every particle in the Universe, then "in principle" we could calculate the entire past and future. The "in principle" was a large leap, when in *practice* we could not compute the entire future of *three* bodies, but the claim expressed the spirit of the age.

In fact it is false, even "in principle," even for classical mechanics: it has a perfectly good proof, but only for motions that do not include collisions. It can be extended to cover two-particle collisions, but Fig. 8 shows that Newton's Laws are not enough to fix the outcome of a triple collision of the hard elastic particles fundamental to Newtonian mechanics. Three gravitating *point* particles can behave even worse.

So the "inexorable laws of physics" on which—for instance—Marx tried to model his laws of history, were never really there. If Newton could not predict the behavior of three balls, could Marx predict that of three people? Any regularity in the behavior of large assemblies of particles or people must be *statistical*, and that has quite a different philosophical taste. ("In Communism the State will probably wither away . . . ?"—hardly.)

The idea of statistical laws as *fundamental* came into physics with quantum theory, and was violently resisted. Einstein refused to believe in "God playing dice." In retrospect we can see that the determinism of *pre*-quantum physics kept itself from ideological bankruptcy only by keeping the three balls of the pawnbroker apart.

Although in the no-collision domain it is a *theorem* that Newton's laws determine the motion for all time, recent work has shown that the difference between apparently regular or random *behavior* is distinct from that between deterministic and probabilistic *equations*.

In one direction, statistical aggregates, even those deeply involving the quantum and uncertain nature of matter, can behave as regularly as statistical mechanics says they should: a laser cannot work without quantum effects, but it is a precision instrument. Equally, not all deterministic equations give steady, regular behavior. The engineering habit of assuming (in the theory of liquid dielectric breakdown, for an up-to-date example) that, if you observe wild behavior, then you must put a random element into your equations, is totally unjustified. Some of the simplest deterministic equations you can write down turn out—when studied topologically—to predict behavior that no experiment could ever distinguish from random fluctuations. Such deterministically generated randomness is fashionably being called *chaos*.

The first traces of chaos were seen by Poincaré around 1899. Having found *one* closed cycle in the motion of, say, the solar system—or even infinitely many—does not imply that *all* motions repeat. The first steps towards finding out what the others do is to look near a repeating one. Sometimes, if you start

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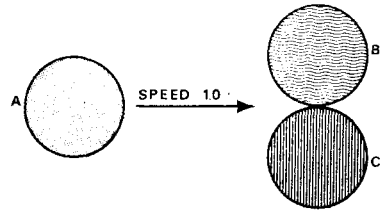

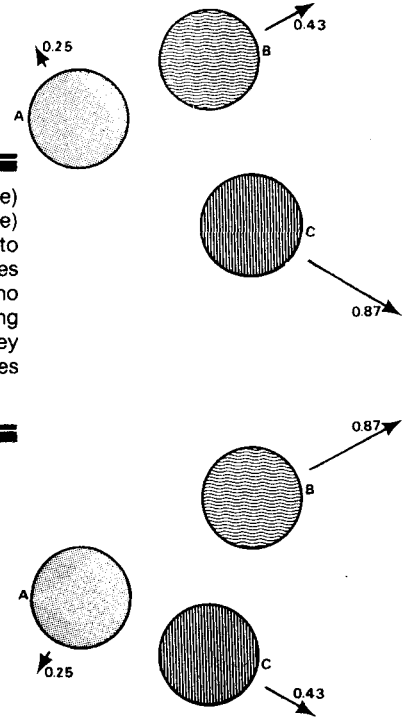

Fig. 8—The billiard shot (first picture) leads almost exactly to (second picture) if A hits B and instant before C, and to (third picture) if it hits C first. If it strikes both exactly at once, the result can no longer be calculated without specifying an internal structure for the balls. They cannot, then, model ultimate pieces of matter.

if it hits C first. If it strikes both exactly at once, the result can no longer be calculated without specifying an internal structure for the balls. They cannot, then, model ultimate pieces of matter.

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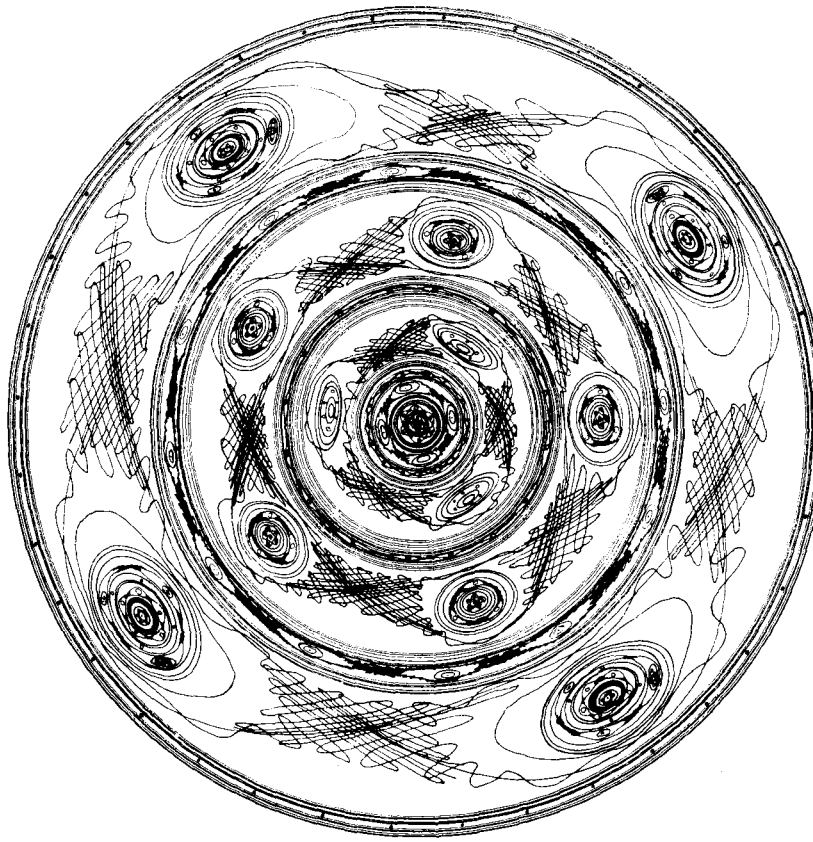

Fig. 9—Tracks of chaos: samples of chaotic behavior near a periodic motion. No wonder Poincaré was horrified!

near a repeating motion (that is, with a nearby initial velocity and position), you always *stay* near it. But the nearby path need not itself repeat. Representative motions are shown in Fig. 9, which is a cross-section of the paths. The central point represents the cyclic motion, and comes back to the same place again and again. A point on any of the surrounding curves comes back to the same curve, but hopping steadily along it with each return. Poincaré had invented enough topology to *find* such behavior, but not to study it further. He was horrified. Only in the 1960s was topology (not to mention abstract-looking fields like number theory) sufficiently advanced to return to the fray, chiefly through the work of Kolmogorov and Arnol'd (in Russia) and Moser

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(in the U.S.). In 1963 the new tools allowed Arnol'd to respond to King Oscar's question about the stability of the Newtonian solar system with a resounding and definitive answer:

"Probably!"

Most of its possible motions are quasi-periodic, that is, behave like a combination of vibrations whose frequencies are not simple fractional multiples of one another. So the planets never *exactly* repeat their positons, but keep on *almost* doing so. But, picking initial conditions at random, you have a small but non-zero chance of following a chaotic motion (like a wiggle, not a circle, in Fig. 9), and then anything could happen, and the system *might* lose a planet—though not terribly fast.

It is impossible to calculate whether we are actually on a tame motion or a wild one by observing the planets (however accurately), because there are wild motions arbitrarily close to any tame one. Even ignoring corrections like Einstein's gravity, the changes in gravitational field due to the motion of unseen planets around neighboring stars are enough to change an initially tame motion to a wild one, or vice versa!

However, the Kolmogorov-Arnol'd-Moser mathematics does have observable consequences. Notably, it leads to predictions about the spacing of the asteroids, and Saturn's rings, in good agreement with observation. And its techniques yield information about quantum behavior too. (In the SF tale "The Girl in the Golden Atom," by Ray Cummings, the lady's world was an electron, but atoms don't resemble solar systems that closely. However, quantum *equations* can resemble classical equations in useful ways, even if the *interpretation* differs.)

It was neither in classical nor quantum mechanics that topologists first developed tools to study chaos. Both systems have conservation of energy built in, and this automatically makes them complicated. Nice, simple systems eventually settle down to rest at some low energy point, independently of initial data: given conservation, this is impossible unless they start at the point, at rest, which isn't very interesting. General systems come somewhere in between, with some types of behavior dominating all the others. A conservative system follows whichever track (wild or tame) it is on; a general one heads towards an *attractor* such as a point or cycle, and follows *that*. So general dynamics are simpler than conservative, because the steady behavior is dominated by the attractors.

With two variables, Poincaré and Bendixson showed (1901) that any attractor was topologically either a point or a cycle. In more dimensions, more things are obviously *possible*, but it was hoped around 1960 that only points and cycles were *typical* in the sense discussed above for catastrophes—which grew in the same mathematical scene. Perhaps any more complicated attractor could be destroyed by making a tiny perturbation of the equations, leaving points and cycles as the only *robust* models, insensitive to the inevitable errors of experiment.

But this is not true.

In the early 1960s Stephen Smale invented a "strange" attractor now known as the *Smale Horseshoe*, showing it to be typical and robust. Rapidly, other

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abstract strange attractors were discovered, by topologists who wrote down dynamics having desired geometric properties, *not* inspired by any scientific problem. But once they had learned enough about them by doing this, they were equipped to find them in "real" equations, and they did.

Strange attractors turned up almost everywhere.

In one of the first economic models ever given mathematical form, by Cournot in 1843.

In a dynamo model of the Earth's magnetism.

In equations written down for the U.S. weather.

In ecology.

In all of these cases, the general pattern is that the system homes in rapidly onto the strange attractor, and then follows it. The motion, once homed in, satisfies all statistical tests for being *random*, not deterministic. The equations being followed, however, do not contain any random terms: they are specific, harmless-looking creatures.

For example, start with a number x between 0 and 1, and generate the new number $4 \times (1 - x)$. Taking this as your new x, repeat this process indefinitely—it is easy (and fun) to program it on a pocket calculator or home computer. The value of x hops around all over the place, with no discernible pattern. But there is nothing random about the formula $4 \times (1 - x)$.

Thus, for instance, stock market movements fit "random walk" theory beautifully, but so do equations of this kind. The distinction between chance and certainty vanishes in practice. In neither picture is it possible to predict the movement of a stock over much time. In the deterministic model, initial data errors grow explosively: you would need *infinitely precise* market data for correct prediction, even if you knew the formula. Try the formula $4 \times (1 - x)$ on two makes of calculator, with the same initial value of x. Their two different treatments of rounding error (even to one part in a million million) mean that after fifty steps or so, the two series of numbers will be completely different.

Turbulence

A particularly good example of chaotic motion is *turbulence*—the noisy flow you get from a faucet turned on full, as against the smooth motion of pouring syrup. It happens in many situations, and has an enormous, puzzled, scientific literature. The practical engineer approximates it by empirical models, usually with a random element. This is fine for specific practical results, in many cases, but where does the randomness come from? The standard equations for flows, known as the Navier-Stokes Equations, have no random terms.

There have been three main attempts to explain turbulence, as follows.

- *The Leray Theory* (1934). The Navier-Stokes Equations break down at some point in time. The approximations on which they are based become inappropriate, and the microscopically statistical behavior of fluid particles breaks into the large-scale behavior.
- *The Hopf-Landau Theory* (1948). Turbulent flow is quasi-periodic, like the "tame" behavior of planets above, with many frequencies, finite in number, superimposed. This theory was

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widely held until recently, although it is suspect on purely topological grounds. Perturb the equations that give it in a mathematically reasonable way, and it disappears. For topological robustness, topologists suggested:

• *The Ruelle-Takens Theory* (1971). Turbulence corresponds to chaotic solutions of the Navier-Stokes Equations, wandering near a strange attractor. This picture was supported by work of Lorenz (1963), who found chaos in a closely related equation. Variants have been proposed, but all have strange attractors as a key ingredient.

Lasers are helping to decide who is right. The American physicists Swinney, Fenstermacher, and Gollub seeded turbulent fluid between two rotating cylinders with tiny polystyrene spheres, fine as dust. Laser light reflected from these spheres shows how fast they are moving, giving rapid and exact measurements of fluid velocity at thousands of points.

A computer can then Fourier-analyze how these velocities change with time. This exploits the mathematical possibility of expressing *any* motion as a combination of sinusoidal oscillations of varying frequency—infinitely many of them. The computer draws a graph showing how big a contribution you get from each frequency, known as a "power spectrum." If this description is relevant, as it is to a vibrating string, and as Hopf and Landau suggested for turbulence, the power spectrum will show a spike at each main contributing frequency. Power spectra taken *prior* to turbulence do indeed show such spikes; but those taken *during* turbulence do not: they show a smudged-out "broad band" behavior, which has largely convinced the experts that the Hopf-Landau Theory is wrong. Current research is aimed at finding a plausible variant of the original Ruelle-Takens model, and some rather specific proposals are emerging.

The turbulence story is typical of scientific work: the key tools came from outside fluid theory. The theoretical key, the strange attractor, came from abstract "pure" mathematics done by topologists seeking a general theory of differential equations, not turbulence. The experimental tool, the laser, came from quantum physics, and was once called "a solution looking for a problem." A direct, all-out "War on Turbulence," like Nixon's on cancer, cutting off funds from apparently unrelated work, would have fared no better than Nixon's did. Turbulence and cancer *need* direct study too, of course. But no scientific domain is an island.

In Conclusion . . .

It is not quite true that physics and topology were completely apart before the 1960s. Birkhoff aside, a quarter of a century ago Krasnoselskii introduced topological tools into bifurcation problems: sudden changes of shape under increasing load, equations changing solution type as conditions alter. Even in 1930 Hermann Weyl—one of the few great 20th-century names known equally well to mathematicians and physicists—could say, "In these days the angel of topology and the devil of abstract algebra fight for the soul of each individual mathematical domain," which for him included much physics. But until very recently, most physicists lis-

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tened mainly to the devil. Any topology that crept into the applications of mathematics had to be disguised, almost, as algebra: "applied" treatments of topological degree theory, for example, firmly squeezed out the geometric viewpoint from which it is most comprehensible.

But beginning in the 1960s and triumphantly in the 1970s, the angel herself has been spreading her newly adult wings over physics and other sciences. We have, in our discussion, omitted entire colors from the spectrum of her light, but even such a limited choice shows her wings as multihued and glorious.

Topology apart, we hope also to have conveyed something of the relation between mathematics and science, as we see it. We stand in humble but resolute opposition to the statement in the May 1979 OMNI by the Nobel physicist Richard Feynman (editorially billed as "the world's smartest man") that "It's a marvelous fact, and one I don't understand, that the mathematicians had investigated groups and so on before they turned up in physics—but in regard to the speed of progress in physics, I don't think it's all that significant." Actually, the 19th-century mathematician Sophus Lie started to study continuous groups because he kept finding them in the equations of contemporary physics: different from today's, but groups are so fundamental that, like topology, they *have* to turn up all over. It is futile to discuss whether, if mathematics had not had group theory ready when modern physicists needed it, they could have done it for themselves (like Feynman's example of Pauli re-inventing quaternions) without making "more than a few weeks' difference." But when physics first brought questions to newly hatched topology, neither mathematicians nor physicists could work out the bulk of the answers for more than half a century. ■

● Dear Mr. President: The canal system of this country is being threatened by a new form of transportation known as "railroads."...As you may well know, Mr. President, "railroad" carriages are pulled at the enormous speed of 15 miles per hour by "engines" which, in addition to endangering life and limb of passengers, roar and snort their way through the countryside, setting fire to crops, scaring the livestock and frightening women and children. The Almighty certainly never intended that people should travel at such breakneck speed.

Martin Van Buren

Governor of New York 1829

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TREMORS

Most of us would welcome a second chance at life. But to what extent would we be willing to share it?

L.A. Taylor

"Anna, I have to talk to you."

Anna met his eyes in the mirror before which she was fastening one of her topaz earrings. "What is it, David?" Her tone was bored, tired. As often.

"I did a reading this afternoon."

"Yes?" Done with the earring, she poked through her jewelry box and came up with the matching necklace. Why she should choose to wear that one—an engagement gift from her first husband—David didn't know. But that was because he didn't care to find out. He didn't like it.

"After my lecture at the University, the one on methods of increasing psychic power? I felt very, very powerful, so I decided to cast my mind forward to see some of my own future."

Anna smiled her small, infuriating smile. She was slender, creamy-skinned with dark hair and eyes, and her image in the mirror was glamorous indeed. David lifted his eyes to look at himself, scarcely believing what he saw: a healthy man of thirty, well-muscled, blond, tanned. Compared to what he had seen in the reading—

"Anna, I am going to develop Parkinson's Disease."

"What's Parkinson's Disease?" she asked, touching her decolletage with perfume. "David, dear, tie your tie. We'll be late."

"It is a disease of the central nervous system," he said through his teeth as he began to struggle with the bow tie. "Characterized by lethargy, loss of voluntary muscle control, excessive salivation, and I don't remember what else. None of it pleasant."

Anna permitted herself a small shiver. "Sounds not. Here, let me help you with that bow. You need to look extra nice at your own publication party."

"Don't you care?" David squealed, letting Anna take over the black silk. "I'm talking about *me*, Anna, *me*! That means us, doesn't it?"

"David, dear," Anna said firmly. "I think it's lovely that you're so very, very fey, and I am delighted that you have written a book about it, but if you remember it was only a month ago that you took out all that life insurance because you foresaw that you would shortly die in an accident. Which is it to be? There." She gave the tie a pat. "Now, let's get our coats on and get moving. The roads are too slick to waste

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any more time."

In silent fury, David followed her down the wide steps to the front door. He had known when he married her that Anna had little respect for the "psychic business," as she called it. What she did respect was the money his books brought in. She had never shared his interest, not even his excitement when he had first read the research report that suggested that knowledge was *not* tied to specific neural cells, but that to some extent what a person thought and remembered—himself, in other words—was distributed throughout the brain. Therefore, it seemed, one part of the brain could be trained—slowly and laboriously, it was true, but trained—to take over from any missing parts, as long as enough of the structure remained.

Even an eminent neurologist had shown interest in the techniques David had developed for strengthening his "presence" in his brain. But that meant nothing to Anna.

The publication party was a success. Many cocktails were served, of which David McCready had more than his share. On the way home he smacked his red Porsche into a bridge abutment, leaving Anna a slightly injured but very wealthy young widow.

Half an hour later a distinguished-looking doctor sat listening for a telephone to be picked up. "Dr. Manden," he identified himself. "Is Mrs. James Colwell there? I must talk to her right away." The doctor leaned forward in his desk chair, playing with a pencil as he waited, his shoulders tensed. "Mrs. Colwell? Dr. Manden. We have the tissue we need to go ahead with the new treatment we discussed. Can you get your husband into the hospital right away?" He looked up as someone handed him a paper, half listening to the woman he had called and half attending to the question being asked. "Oh, really?" he said into the telephone. "I've been at the hospital all day. I didn't realize the weather had turned so bad. Could you try? I don't know when we'll get such a good match again."

After a few more words of encouragement, the doctor hung up and shot out of his chair. "Are they keeping him going?" he asked.

"Sure, they need the heart and kidneys," someone in a green paper smock assured him. "The brain will keep another half hour for your purposes, won't it?"

Dr. Manden nodded, already hurrying down the barren hall of the surgical building. "I want to make sure they don't louse up," he said. "Colwell will be here. His wife is spunkier than she lets on."

"You really going to inject some of that brain into the guy?"

"Last chance," Dr. Manden said. "The L-dopa doesn't control his parkinsonism anymore. The only hope is that we can transplant enough brain cells to make dopamine for him. So, we'll try, and with luck we can all go home and have a nice Thanksgiving."

"Hard to be the first," green smock commented.

"Works in monkeys," Manden pointed out. "And people have been doing it in mice since 1980 or thereabouts."

"Don't other chemicals get elaborated, too?"

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"Of course they do," Manden said patiently. "Any chemicals the cells made in the original brain, they will make in the new one. But they are all normal brain chemicals, under the hormonal control of the host body, and they just don't count. What counts is the renewed ability of the host brain to make the missing chemicals." He made an impatient gesture, slicing at the air ahead of him as if to clear away all difficulties. "Now we have the perfect chance to try it in a human being. But we don't have much time, so we'd better get moving."

At two-thirty that morning he injected a fresh preparation of selected brain cells belonging to a blond, thirty-year-old accident victim into the brain of a grey, fifty-year-old man with uncontrollable tremors, never dreaming that the cells in that preparation had foreseen, dimly, his action.

The trees outside the office window were covered with a mist of green formed, Dr. Manden saw, by the emergence of hundreds of tiny green ruffled leaves from the dark buds that had brushed at the glass all winter long. The hospital lawn was greening up, too, and in the frost-pocked mud of the flower beds he could see some kind of plant emerging. Tulips, that was it, or daffodils. Something like that. The intercom dinged and Dr. Manden turned from his uncharacteristic contemplation of nature to answer it.

"James Colwell in room two, doctor," the intercom said.

"Be right there." Dr. Manden stood up to slip on his white jacket, fighting dizziness, and leaned over his desk to check his calendar. Two patients today, possible experimental subjects, both of them; he was getting too weak to do the surgery himself, although the research would go on under his supervision as long as he was able to do the job. Then, this afternoon, a transfusion. He ran his hand over what was left of his hair, grimaced as he shook off the few hairs that clung to his hand, and set forth.

James Colwell perched on the edge of the examining table, looking chipper. "Hi, Doc," he said. "How ya doin'?"

Dr. Manden resisted the temptation to tell him. "Fine," he said heartily. "You look pretty good yourself."

"I feel great," Colwell grinned. "Comparatively speaking."

Dr. Manden felt in his pocket for his stethoscope. "I'll just check you out, okay?"

He performed his examination with very nearly his usual efficiency and dispatch. No patient would notice the difference, he told himself. But where he should—would, a month ago—have felt intense pride at what he found in examining James Colwell, today he was aware only of a bleak jealousy that the man should be doing so well at his hands, while he could do nothing for himself. "Get dressed and come on down to the office, Jim," he said finally. "We might as well be comfortable. I want to talk to you."

Colwell was quick. No one who hadn't seen it would have believed that five months before, the man had been unable to dress himself, hadn't had the energy to lift his head to watch a football game on TV, had drooled down his chin until the flesh was raw.

"There's still some slight evidence

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of the parkinsonism," Dr. Manden told him. "Not much, though. I doubt anybody but a physician could pick it up. How are you doing otherwise?"

Colwell lowered his eyes, thrust out his chin, and sucked at his lower lip for a few seconds. "Well, there's just one thing," he said finally. "My mind is playing a funny kind of trick on me."

"Trick?"

"Like, I look at Betty—now, she's been my wife for going on thirty years, so I should have a pretty good idea what she looks like, right? But every once in a while, and it's getting more often lately, I look at her and I'm surprised that her eyes are blue. Like I expected them to be brown, you know? Bugs me."

"I can see that," Dr. Manden said. "Anything else?"

"Well, sometimes it even happens with me. I mean, I look in the mirror and I'm surprised what I look like, sort of. Not being so old-looking at my age—I can understand that—but I expect something I never did look like, blond hair and blue eyes, and you can see my eyes are brown, always have been. Now, I should know what color my own eyes are even better than I know Betty's, right?"

"Yes, of course," said Dr. Manden. "And this has been happening more often, too?" A memory was playing around the fringe of his own mind, but he couldn't pin it down, with this cursed weakness he had to concentrate to conceal. Maybe it would come when he could relax.

"More and more. And," Colwell continued, "I have funny dreams, and maybe a few days later something that happened in the dream will happen for real. That never happened to me before. And once in a while I see somebody in a store or on the street and I say hi before I even know I'm gonna, and they just look at me like I'm crazy, but I *know* that person even though I can't put a name to them usually . . ."

"I see." Manden pressed his fingers down the pencil, raised his hand, let the pencil slide down. What was he trying to think of? "Sometimes patients treated with L-dopa have some mental side-effects," he said slowly. "Maybe this is some kind of delayed effect from all those years of therapy."

"I'm nuts, is that what you're saying?" Colwell asked without rancor. "I've wondered. But I can hold down my job, and me and Betty get along fine. That counts for something, don't it?"

"It does indeed," Dr. Manden agreed. "It counts for a lot." He slowly circled the word "transfusion" in the 2:30 slot of his desk calendar and laid the pencil down. "I don't quite know what to say to you, Jim," he confessed. "Let me know how it goes, will you? If it gets better, or worse?"

"Names," Colwell said wanly. "I get names mixed up, too. Like just now I had to stop and think who Jim was. That don't make sense."

"No." Dr. Manden rose, went around the desk to meet Colwell as the man also stood, shook hands. "Keep in close touch," he said. "I'll call you if I can think of anything."

"Sure." Colwell gathered up his jacket and cap. "Hey, you've got my book. Neat," he said. "Well, see you, Doc." He went out, closing the door

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softly behind him.

His book? Dr. Manden frowned at the table Colwell had glanced at. Nothing there but medical books . . . except . . . he picked up a thick book in a blue dust jacket. The thickness was all in the choice of paper, and he'd been amused when the book had arrived. The author's widow had sent it, since the man's brain had been used . . . Manden opened the book. The note was still inside:

Dr. Manden,

The night he died, David told me that he had foreseen that he would develop Parkinson's Disease. When I gave permission for his body to be used for others, I had no idea you would use it to treat that same disease! But I was pleased by your explanation and your thank-you note, and I'm sending you a copy of David's book in case you are interested.

Anna McCready

Manden turned the book over and studied the picture of the blond young man on the back of the dust jacket. With rising excitement, he went to his desk and opened the Colwell record. Yes, this was the man whose brain had been used to treat Colwell!

"Well known for his study of psychic phenomena," the dust jacket blurb read, "Mr. McCready has developed a method of strengthening mental power of which a prominent neurologist has said, 'This may be the most exciting development in the treatment of brain damage in the last century.' "

Blond hair. Light-colored eyes, probably blue. Manden's hands began to shake. He was dealing with the direct transmission of knowledge! That explained Colwell's uneasiness about something so commonplace as eye color, his confusion about names, his greeting of strangers. Shades of the Michigan planaria, learning their way through mazes by cannibalism!

So here was a way to go on.

Carefully, because his hands were still shaking, Dr. Manden ripped the notes he had made on Colwell into tiny pieces and crumpled them into a ball with a piece of plain paper. Nobody would have to know what Colwell had experienced. He could be passed off as a latent schizophrenic. . . .

He could will his own brain to the study, and within months some portion of his knowledge and experience would have revived in that other brain. . . . His elation was making Manden short of breath; his heart knocked at his throat. That transfusion was really overdue. Damn the hematologists, anyway.

A discreet tap at the door claimed his attention. "Yes?" he called.

James Colwell poked his head around the door. "May I come in?" he asked.

Manden's hands tightened on his pencil. "Certainly." The man sounded different, somehow, but he couldn't put his finger on it. He carried himself differently, too, as he shut the door and took the two steps that carried him to the cluttered desk. "What can I do for you, Jim?"

"Call me Jim-Dave," the man said. "You've guessed, haven't you? I could feel it trembling on the brink, so to speak."

Dr. Manden blinked.

"Change your will, Doctor. Tell

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them they can't use your brain."

"Will?"

"I can see what you're planning. Don't do it," Colwell continued. "I know you've got leukemia, I know it's killing you fast and you want to finish your research, but stop and think—what will you do without credentials?"

"Credentials?"

"Tickets, doctor. Coupons. Medical degree, Board certification, papers published. Grants. You can get pretty frustrated, believe me." Colwell flashed a grim, almost feral smile. "I don't even *like* Betty," he added.

"Oh." Manden thought long and hard, with this newly vital man poised across his desk. Then his shoulders sagged into defeat. "I think I see what to do," he said weakly. He reached out and drew his prescription pad toward him.

"This should help." Slowly, firmly despite his shaking hand, he wrote out a prescription for a medication used against a disease he knew perfectly well the man before him didn't have, a prescription for a drug known to make parkinsonism worse, because it destroyed dopamine in the body. And a hefty dose, barely low enough that a pharmacist wouldn't question it.

"Don't take this to your usual drug store," Manden said.

"The Parkinson's will come back, but I'll still be stuck in here, right?" Manden met Colwell-McCready's eyes and nodded.

The man winced. "Help me get out and it's a deal."

"Deal," Manden agreed. Quickly, before he could think about it killing.

Colwell reached out for the slip of paper, nodded, turned. Walked to the door, looked over his shoulder, gave Manden a faint smile. Opened the door and walked through, taking all the years of research with him. Or them, Manden supposed.

He looked down at the pen in his hand. Very deliberately he drew a line beneath the word "transfusion" on his calendar. There was a treatment, something new, he had refused, afraid of unknown side effects . . .

Manden snorted. And now the world would believe that a transplant of adult brain cells produced only a temporary improvement in Parkinsonism, followed by a terrible relapse. But wasn't that better than the nightmare he had glimpsed, the rich, the brilliant, fighting for the chance to share some luckless person's skull? People selling themselves as surrogates, maybe; the mentally defective used willy-nilly as a kind of draft animal. . . .

No. Not acceptable. And it would have happened, he knew. He was, had been, ready to do it himself. Now he'd just have to hang on until he found something better, something without the . . . complications. Gazing at the new leaves trembling in the breeze outside his window, he began to believe he could. ■

● When you lose your power to laugh, you lose your power to think straight.

Jerome Lawrence and Robert E. Lee

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a calendar of analog upcoming events

30 October-1 November
FANTASYCON VII (World Fantasy Convention) at Claremont Hotel, Berkeley, Calif. Registration $25 (Limited to 750), $10 supporting. Info: 7th World Fantasy Convention, c/o Dark Carnival SF+F Bookstore, 2812 Telegraph Ave., Berkeley CA 94705. (415) 845-7757.

1-4 November
Fifth Annual Symposium on Computer Applications in Medical Care (IEEE CS) at Washington, D.C. Info: Jan Eldridge, Office of Continuing Medical Education, George Washington University Medical Center, 2300 K St NW, Washington DC 20037. 202-676-4285.

5-7 November
LOSCON '81 (Los Angeles-area SF conference at Huntington Sheraton, Pasadena, Calif. Pro Guest of Honor—William Rotsler; Fan Guests of Honor—June and Len Moffatt. Info: LASFS, 11513 Burbank Blvd., North Hollywood CA 91601.

9-11 November
ACM Annual Conference at Los Angeles, Calif. Info: ACM, 1133 Avenue of the Americas, New York NY 10036.

13-15 November
FUTURE PARTY '81 at Marriott Hotel, Tampa, Fla. Guests: Jesco von Puttkamer, Dave Kyle, Theodore Sturgeon. Registration: $10 in advance, $20 at the door. Info: Scott Baker, 12103 Cypress Hollow Place, Tampa Fl 33624.

20-22 November
Contradiction (Buffalo-area SF conference). Info: send SASE to Linda Michaels, 27 Argosy Drive, Amherst NY 14226.

23-25 November
General meeting of the American Physical Society at New Orleans, La. Info: American Physical Society, 335 East 45th Street, New York NY 10017.

30 November-1 December
Seventh Annual Conference, Mid-Hudson Modern Language Association at Marist College, Poughkeepsie, N.Y. Academic conference on science fiction and fantasy. Info: Susan McLean, Dept. of English, Scott Hall, Rutgers University, New Brunswick NJ 08903.

2-6 September 1982
CHICON IV (40th World Science Fiction Convention) at Hyatt Regency Chicago Hotel, Chicago, Ill. Guest of Honor—A. Bertram Chandler; Artist Guest of Honor—Frank Kelly Freas; Fan Guest of Honor—Lee Hoffman. Registration—$15 supporting at all times. Attending—$30 until 30 June 1981, higher thereafter. This is the SF universe's annual get-together. Professionals and readers from all over the world will be in attendance. Talks, panels, films, fancy dress competition, the works. Join now and get to nominate and vote for the Hugo Awards and the John W. Campbell Award for Best New Writer. Info: Chicon IV, Box A3120, Chicago IL 60690.■

—ANTHONY LEWIS

Items for the Calendar should be sent to the Editorial Offices ***five months*** *in advance of the issue in which you want the item to appear.*

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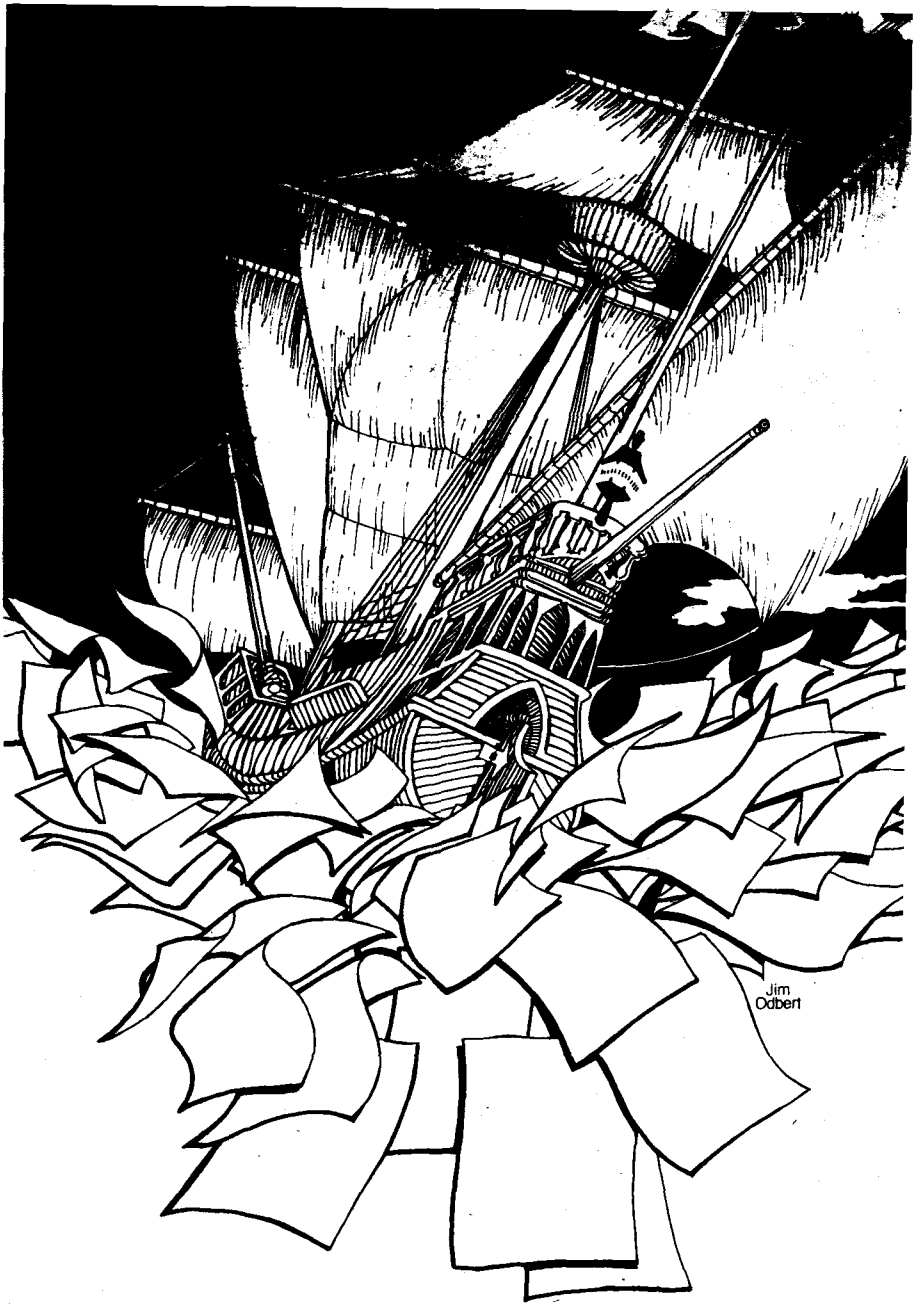

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Most Gracious Majesty!

I will be forever in your debt for your intercession on my behalf during my recent trial. I will carry out your wishes and lead the Second Voyage of Discovery across the Western Ocean, for the Glory of Spain and the Holy Faith.

C. Columbus
Admiral of the Ocean Sea

To: C. Columbus, AOS
Fm: Dress Code Compliance Officer
Leon and Castile National Sea Laboratory (LACNSL)
Subj: Compliance with the LACNSL Dress Code

To enhance our image we desire a more formal mode of attire on the part of the staff, both when attending functions outside LACNSL and when entertaining visitors aboard ship and at other work sites.

You failed to meet those standards during your recent meeting with Her Majesty.

While it is true that the dress code has not been formalized, we merely ask for conventional business attire. For example, we will not tolerate barefoot crewpersons or sandalled officers.

Furthermore, surely you are aware of

Or, C. Columbus rides again—
with a little help (?) from Management.

Al Charmatz

A Second Chance

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the psychological benefits of dressing in a manner that distinguishes you from your subordinates.

To: C. Columbus, AOS
Fm: Senior Contract Administrator
Subj: 4-Z81-1573M, Proposal to Study New Sea Routes

In regards to our conversation about a revised technical evaluation for the above referenced proposal, let me reiterate my request. We require a specific statement as to the facts that:

(a) 98 hours of an associate captain's time, 820 hours of a senior lieutenant's time, and 650 hours of a junior lieutenant's time are sufficient time to complete this study, and that these categories of workers are the correct people to be performing this task.

(b) 110 hours of LACNSL computing engine time are sufficient for this task because . . . (it would take LACNSL ships personnel "x" number of computer time to do this or a similar task).

(c) Two (2) trips to the capital city are required because . . . (why won't one [1] trip do?).

The above outline is to be used as a guide only. Your memo was submitted through a preliminary review and it was refused for lack of detail, i.e., the detail requested above. Your memo gave a qualitative opinion only, not the quantitative data required to withstand audit.

Please contact me with any questions. As it stands now all further action is pending your response to this letter. The fact that we lost the files twice is irrelevant.

To: C. Columbus, AOS
Fm: Western Explorations (WX) Division Leader
Subj: Current Fiscal Year Appropriations

We have not received the funding we requested and may be short by 10 to 20 percent. Effective immediately you will defer all non-essential expenditures.

To: C. Columbus, AOS
Fm: Program Manager/Dept. of Discoveries (PM/DOD)
Subj: Surcharges

To obtain funds for the services rendered by this office, surcharges on reimbursable programs are increased from 5 percent to 25 percent, effective immediately.

To: PM/DOD
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: Tax Rates and Our BMD Programs

A funding crisis exists in the project to defend our high-value assets (our sailing vessels) against missiles carrying Greek Fire that may be launched ballistically by the Armies of the Great Khan.

We are working with the Ballistic Missile Defense Agency and their systems contractor, the Leon Missile System Company. We are having difficulty explaining to them exactly what they are getting for the 5 percent (now, 25 percent, and no limit in sight) surtax. Cannot these taxes be controlled?

To: C. Columbus, AOS
Fm: PM/DOD
Subj: What You Get For Your Tax Money

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Your comments have been received and noted in your file.

We have a great deal of highly paid talent, performing marketing studies and otherwise guiding programs, writing procedural rules, briefing higher levels of authority, etc. All that talent and travel does not come cheap.

A major part of our funding will be spent on a mission analysis that will examine the strategic policy scenario. Subsequently we will address technical details. Our consultants, the Deputy Over-Directors Doing Early Retirement and Extended Research (the DODDER-ERs) assist in marketing guidance.

To: C. Columbus, AOS
Fm: Asst PM/DOD
Subj: Briefings for the Sovereigns

On Monday next you will present to me your program plan for discoveries during the follow-on voyage across the Western Ocean.

After one week to analyze and consider your plans, we will have a further meeting during which I will describe to you my interpretation of that program. You will have an opportunity to review my verbal presentation and the visual aids I will develop.

Subsequently I will give that presentation to the PM/DOD who will then present the program to the Director. In turn he will present the program to the Sovereigns, with the PM/DOD in attendance.

You should consider our meeting as your opportunity to ensure that we have all the data necessary to present adequately your thoughts and plans.

I have read your harsh comments about tax rates. If we had not increased the tax rates you would not be getting this service from us and would have had to present the program plans yourself.

To: Chief, Zero Industriousness Agency (ZIA)
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: Speed of Travel Along Waterways

I cannot move supplies and crew to my ships because your people using government transportation are proceeding along waterways at incredibly slow speeds. Recently an oar-powered vessel, safety-rated for four persons but carrying six, was proceeding along a waterway. Only one man was rowing (he was using only one oar). Empty wineskins were being tossed overboard. Because of the slow speed many other boats were being delayed.

This practice of maximizing travel-time and minimizing time-on-the-job is not unusual. It delays our crews. Can anything be done?

To: Chief, ZIA
Fm: Chief Steward, Union Local No. 87545
Subj: Strike Call

Our hardworking members are being slandered. A work stoppage is hereby called. Pickets will be set up at all sites. The strike will continue until hunting season is over.

To: C. Columbus, AOS
Fm: Chief, Administration
Subj: Annual Merit Increases

As usual, funds available for annual wage increases are limited.

1. *Managers*. This year we have expanded our managerial organization,

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adding many new people to the managerial hierarchy. With their increased responsibilities should come a financial recognition of their increased worth. Therefore you are directed to divert funds from your normal annual raise distribution to allow an "adjustment" for the managers.

II. *New Crewpersons.* Because the future of LACNSL depends on hiring and retaining new, bright talent, we must offer starting salaries and initial raises that are competitive. You are directed to divert funds from your normal raise distribution for this purpose.

III. *Longterm Seamen.* This group should comprise the source of raise money for the most important part of your fleet, the new managers and the apprentice seamen.

To: C. Columbus, AOS
Fm: Material Fabrication Division
Subj: Work Assignments and Cost Overruns

Orders for masts, sails, and iron fittings are placed in the particular shop that has excess capacity at the time we receive your order. Frequently we are able to place the work in our apprentice shops or in others where the artisans have no previous experience in building the parts you require. You should be proud of your contribution to upgrading the general experience level of our artisans.

Our accountants demand full cost recovery. You have not accepted the products of our apprentices and other artisans. Your rejection of those articles has resulted in cost overruns for which we are billing you.

To: C. Columbus, AOS
Fm: Fiscal Management Office (FMO)
Subj: Cost Overruns in the Shops

Watch your shop costs. Can't you estimate your requirements any better?

To: C. Columbus, AOS
Fm: PM/DOD
Subj: Peer Review of Proposed Plan for the Second Voyage

The DODDERERs have been unable to achieve a consensus on the cost/benefit ratio for the subject voyage and for the exploration and development program you have proposed.

To simplify assessment we have decided to subject your proposal to a peer review. Only one reviewer has been selected. To ensure a thorough rather than a pro forma review, we have selected the president of the Flat Earth Society. There will be no appeal.

To: C. Columbus, AOS
Fm: Manager, Twelfth Yacht Plant (Y-12)
Subj: Hardware Cost

Your recent purchase orders for new vessels and for special weapon components, explosives to be launched at the Armies of the Great Khan, have been filled.

We estimated costs when you sent us drawings. As occasionally happens, we made a small error and underestimated the cost by a factor of five. We work on a full cost-recovery basis, so you are being billed for the balance.

To: C. Columbus, AOS
Fm: FMO
Subj: Cost Overruns

You are again overrunning your

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budget. We are bringing this dereliction to the attention of the Program Manager, for his information in preparing your next performance appraisal.

To: C. Columbus, AOS
Fm: Computing Division
Subj: Calculational Support

With the introduction of new mechanical computing apparatus from Cathay we have increased greatly our computational capability, so we can calculate the efficiency of new hull designs, new sail configurations, ocean currents, and the density of sea serpents and other natural phenomena.

We pledge not to change systems specifications and software for a period of at least five years (unless we believe we have an improvement to offer).

To: C. Columbus, AOS
Fm: Human Rights Commission
Subj: Discrimination Charges

Discrimination charges have been filed against you by one of the native crewpersons from the Western Islands. He states that the boatswain in charge of the starboard watch aboard the *Pinta* systematically discriminated against him because of his ethnic (Western Islands) origin, that crewmen of Iberian descent have received preference, that his immediate superior is also Hispanic, and that you are not of the same ethnic origin as he and hence must necessarily have discriminated against him.

You have two days to obtain written statements from the immediate parties involved. You will present yourself to this Commission in the Provincial Capital of the Holy Faith in ten days or a subpoena will be issued for your appearance.

To: Affirmative Action/Equal Employment Office
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: Discrimination Charges

By the time I received the attached letter of charges from the Human Rights Commission the reply due date had already passed. I assume you will assist in gathering statements and negotiating with the Human Rights Commission.

To: C. Columbus, AOS
Fm: AA/EEO
Subj: Discrimination Charges

We will perform the necessary paperwork in LACNSL's (and your) defense. We will submit all written comments, hearsay and rumors, unevaluated, to the HRC.

You should be prepared for the likelihood that you will have to testify in person to clear yourself of these charges and that you will be found guilty.

We suggest that you set the sailing date as early as possible, to avoid an injunction against your departure from the jurisdiction of the HRC. If the fleet doesn't sail soon, you may not be able to accompany it.

To: All Employees
Fm: Logo Selection Office
Subj: Solicitation of Designs for a New Logo

We have decided to update our image by replacing our current logo. Although the old one (a map of the Iberian Peninsula with a superimposed Anchor) has served us well, the significance is not

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clear to people beyond Iberia. Besides, it hasn't been changed since the formation of LACNSL.

You are invited to propose designs for a new logo. Note that we have removed the word "Scientific" from our name; we haven't done scientific work in a long time.

To: C. Columbus, AOS
Fm: Environmental Protection Office
Subj: Environmental Impact Statement

The Environmental Protection Agency requires an Environmental Impact Statement regarding the expected effects of your voyage and discoveries before you will be allowed to sail.

You are asked to address the following areas: Effect on the Nation of building and equipping the ships, including deforestation, removal of able-bodied men from farming and other pursuits, etc.; effect of developing colonies and sources of raw materials; effect of contaminating the ocean with raw sewage; effect of altering the world-view perceptions of the natives you will contact; effect of altering their quality of life; effect on the Nation's economy if large sources of gold and/or silver are found; effect of altering the balance of power with Portugal; religio-political implications of disproving the Flat Earth Theory; etc. Obvious advantages include propagation of the Holy Faith; instillation of the work ethic in the natives by labor in fields and mines, etc.

To: Senior Management Group
Fm: Chief, Administration
Subj: Employee Morale

At the recent "retreat" for the SMG a major presentation by one of our consultants indicated a perception that we are undergoing a crisis of confidence.

We decided it would be good public relations to take an employee attitude survey and to follow the principles of modern participatory management. Thus we will consult with small groups of our employees for face-to-face comments and discussion. Furthermore, we will institute seniority awards, recognizing survival of the travails of pitching ships and demonstration of surety of foot and agility aloft with selected items of Nimbleware Pottery.

This should pacify the natives.

To: C. Columbus, AOS
Fm: WX Division Leader
Subj: Current Year Budget

Funding looks even worse than we feared. Cancel all long-range plans.

To: All Employees
Fm: Employee Attitude Survey Office
Subj: Result of Survey

With the exception of a few malcontents we find that you are all happy and quite content with your lot and the way that LACNSL is preparing to enter the challenging 16th century.

To: Wage Administration
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: Salaries, LACNSL vs LACTA

Recently I lost my pilot-navigator to the Leon and Castile Technical Associates (LACTA), which hired him at double his LACNSL salary and promptly reassigned him to my flagship. They could do so because of their lower overhead. Other key members of my crew

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are considering doing the same. All crewmen who know of this are unhappy.

I believe our policy of contracting for allegedly short-term technical assistance is self-defeating as currently implemented. It attempts to bring new, temporary help to our fleet but actually encourages a shifting away of crew personnel and loyalties.

To: C. Columbus, AOS
Fm: Wage Administration
Subj: LACTA

You fail to perceive the principal advantage of contracting out the hiring of seamen to LACTA. In the event of a budget cutback we will terminate our contracts with LACTA, thus reducing our budget at no sacrifice in our staff. Although there may be few seamen left at LACNSL, the managerial and support staff will still be here. Thus we can later build up another fleet, using as a cadre our trained managers and administrative support staff, the true core of LACNSL.

To: All Employees
Fm: Chief, Administration
Subj: New Managerial Structure

To tighten control, to formalize and standardize operating procedures and channels of communication, to present a promotional ladder for managers, and to establish an unambiguous ranking of value, the following managerial hierarchy (based on Department of Exploration, DOE, and other modern organizational models) is hereby announced:

M-6 The Sovereigns

M-5 Director, Deputy Director

M-4 Associate Directors (AD), Deputy Associate Directors (DAD), Deputy Assistant Associate Directors (DAAD), Assistant Deputy Associate Directors (ADAD), Associate Deputy Assistant Directors (ASSDAD), Program Managers

M-3 Admirals of the Ocean Sea

M-2 Captains

M-1 Watch Commanders

To: Chief, Administration
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: New Managerial Structure

Where is the line of technical-professional advancement for crewmen? The new structure rewards crewmen who leave their ships to enter the managerial system. Already I find that many of my less competent seamen perceive this to be the path to advancement, recognition, and financial reward. If they cannot advance as able-bodied seamen, then they will as "super captains." I fear they will soon outnumber (if they haven't already) the few technically competent managers we have.

I cannot understand this delight in rearranging boxes on the organizational chart and concoction of new titles. This tremendous managerial superstructure is supported only by a small base of active producers, the seamen and peasants. Why won't this system collapse, as did the Egyptian socio-political system when the producing base was undermined by failures of the Nile River?

To: C. Columbus, AOS
Fm: Chief, Administration
Subj: New Organization Structure

We have established the relative responsibility, authority, and worth within the managerial structure of LACNSL.

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We now have a box for everyone. When everyone is in his box the organization will run smoothly. It will.

We recognize that the producing base (zeroes on the managerial chart) is essential to the health of LACNSL, so we do not wish to disturb their equanimity.

It took fifty years for the Egyptian system at the peak of its complexity to collapse.

To: C. Columbus, AOS
Fm: Stores Dept.
Subj: Spare Parts

Your ship's chandler has been extremely abusive and we wish him reprimanded. This morning he presented a request for one thousand (1,000) sailmaker's needles, because your fleet will be sailing within one week.

The standard unit of issue is "singles." We keep in stock a total of ten (10) needles. Any request for a larger order must be accompanied by a Memorandum of Justification and a Purchase Request Form. After approval, a Purchase Order Number will be issued and your order will be placed in the queue for servicing. Currently we estimate delivery six months after the order is placed.

By reducing inventory we effected a significant reduction in funds tied up in otherwise unused materials. Furthermore, you may be surprised to learn how many orders are cancelled when the ordering parties learn of the expected delivery date. It is obvious that those orders are unnecessary.

To: Distribution
Fm: DAD/Nautical Security Programs
Subj: Transmittal of Critical Nautical Warfare Deployment Information (CNWDI)

At a recent meeting with DOD contractor personnel at a DOD installation, CNWDI was transmitted by C. Columbus's officers and representatives of the Leeward Lisbon National Laboratory (LLNL) to a large audience, most of whom had no true "need-to-know."

I am calling a meeting to discuss this matter, with representatives of the Warfare Systems Office, the PM/DOD, and the Foreign Intelligence Office. No one else need attend.

To: C. Columbus, Admiral of the Ocean Sea
Fm: Foreign Intelligence Office
Subj: The Grand Awakening

We discussed the recent DOD/DOE review meeting in which everyone from the janitor to the owner of the local winery and bistro appeared to be present with a DOD-certified CNWDI clearance. You or your officers should have been present. In many instances we did not know the answers to questions only you could have responded to.

In this not atypical fashion we held a meeting with a maximum of hand-wringing, viewing-with-alarm, and disclaimers of knowledge or responsibility, and with a minimum exchange of hard information.

To: C. Columbus, AOS
Fm: Accounting Office
Subj: Program Cost Codes

An updated list of program cost codes is transmitted herewith. Changes from previous editions are listed below.

Added: C002 - Voyage No. 2 - Man-

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power (on-continent)
C302 - Voyage No. 2 - Hardware and Materials
C602 - Voyage No. 2 - Manpower (off-continent)

Deleted: C001, C301, C601, for completed First Voyage.

To: C. Columbus, AOS
Fm: Fiscal Management Office (FMO)
Subj: Funding for Programs CXX2

In Fiscal Year 1494 (1 Oct 93 - 30 Sep 94) the allocations for C302 and C602 have been deleted and funds transferred to C002.

To: FMO
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: How Do We Sail Without Funding?

You have deleted all funding for materials (ships and stores) and for seagoing crew in favor of shore-bound work. Surely funds have to be allocated for ships and their crews.

To: C. Columbus, AOS
Fm: FMO
Subj: Program Cost Codes

The cost codes for materials and seagoing crew were deleted because we informed DOE that we would not be charging any major exploration programs off-continent during FY 1494.

Charge all program costs, including major off-continent exploration programs, to C002.

To: FMO
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: Misuse of Program Cost Codes

I thought program cost codes were imposed for the purpose of keeping track of expenditures, for budgetary control. Why then do we deliberately falsify entries? If we must do this, why bother in the first place?

To: C. Columbus, AOS
Fm: FMO
Subj: Program Cost Codes

Our staff maintains and monitors program cost codes and provides statistical analyses, assisting in long-range planning. We need those codes.

You are aware of the long-range goal: a crewperson for every task, a program code for every crewperson, and a program manager for every program code. Thus we will follow the latest trends in micromanagement and achieve our objective of one fulltime manager or assistant manager for every crewperson. Working hand in hand we all will prosper.

To: Defense Nautical Agency (DNA)
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: Experiment Proposal — Effects Test FLIMSY REED

Objective: To verify capability of the Mark 4 Caravel to withstand the hostile environments of storm, sea, and sun before committing to full-scale production.

Justification: We plan to explore lands beyond the Western Ocean. We require a proven design for the ships, vehicles that we will use to reenter the New World.

Approach: We wish to participate on the next DNA Effects Test, code-named FLIMSY REED. Full-scale mockups of

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the reentry vehicles will be exposed to intense combinations of storm, sea, and sun. A description of our experiment matrix is attached.

To: C. Columbus, AOS
Fm: DNA
Subj: Experiments on FLIMSY REED

The experiments are approved. The schedule for Final Proposal Review, Experiment Installation, and the Test Readiness Date is attached.

To: DNA
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: FLIMSY REED Test Schedule

We can meet the Final Proposal Review date but we cannot meet Installation and Readiness Dates.

We understand that we are the prime experimenter. We formally request that you adjust the schedule. We must have more time.

To: C. Columbus, AOS
Fm: DNA
Subj: FLIMSY REED Schedule

We have examined our funding allocation and must complete FLIMSY REED during the current Fiscal Year. If we take longer costs will eat us up. Furthermore, our equipment is not in the best of shape and we have to perform the test before the equipment all falls apart or burns up.

You are the prime experimenter.

The Installation and Readiness Dates are unchanged. If you are not ready we will go ahead without you.

We will continue to assist you in meeting your test objectives.

To: Distribution
Fm: PM/DOD
Subj: Western Voyage No. 2

This summarizes the conclusions reached at today's meeting:

1. The voyage will be captained by C. Columbus, AOS.

2. The objective will be to establish a colony in Hispaniola, with a further objective the conversion of the natives, for which purpose six priests are assigned to the fleet.

3. C. Columbus is authorized to recruit 1200 sailors, soldiers, and colonists.

4. He is allocated 17.5 vessels.

5. The surcharge placed on this voyage is 25 percent, computed on the wages paid all personnel.

To: PM/DOD
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: Resource Allocation

Why was I not invited to the resource allocation meeting?

Why don't you take your tax out of the fractional ship allotted me?

To: C. Columbus, AOS
Fm: PM/DOD
Subj: Resource Allocation

You were not invited to the meeting because we knew your position beforehand. We wished to have a harmonious meeting, so only team players and our consultants, the DODDERERs, were invited.

To: C. Columbus, AOS
Fm: WX-Division Leader
Subj: Reorganization

To enable us to respond more effec-

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tively to new tasks and opportunities, I am announcing our reorganization. You will divide your crewmen by disciplines and functions, assigning them to different administrative units. Those units will then reassign them to specific vessels. Although working relationships will change, we will be able to form new teams rapidly in response to new exploration demands.

We also intend to concentrate functions and facilities at one location. Because of a temporary space shortage you will distribute your fleet among seven anchorages.

These improvements will increase our overall efficiency in the long run.

To: WX-Division Leader
Fm: C. Columbus, Admiral of the Ocean Sea
Subj: Reorganization

In the long run we will all be dead.

I will sail immediately, before we are subject to the benefits of this reorganization.

To: C. Columbus, AOS
Fm: PM/DOD
Subj: Weekly Progress Reports—Second Voyage

Weekly progress reports will be sent to this office during the voyage, employing Long Range Carrier Pigeons that we will supply as Government Furnished Equipment (GFE).

Our judgment of the success of your voyage (with its implications to your performance appraisal and annual merit review) will be based on the regularity of the reports submitted by the on-board Assistant Program Managers and their assessment of your performance as a member of the LACNSL team.

To: All News Media
Fm: Public Relations
Subj: News Release—Departure of the Second Voyage of Discovery
(For Immediate Release)

As the departure of the Grand Fleet draws near, all personnel are hard at work, completing their preparations with joyous spirits and eager hands. Morale is high as the crewpersons prepare to voyage forth.

Under the inspiring leadership of the Program Managers Office, with the assistance of C. Columbus (AOS), they will carry the Flag and the Cross to new lands across the Western Ocean.

Never have so many owed so much to so few Program Managers.

To: PM/DOD
Fm: Assistant PM/DOD Aboard *Santa Maria* (Mariagalante)
Subj: Loss of Reporting Capability
(For later hand delivery)

Our reporting instruments (the GFE pigeons) were diverted from their mission of conveying weekly progress reports to another role. They are not available for transmission of data to LACNSL.

We have evidence that C. Columbus encouraged diversion of the GFE pigeons to the Officers' Mess, where they were all eaten.

Discovery of this sabotage required drastic action. Accordingly, C. Columbus (formerly AOS) has been stripped of his command, placed in irons, and will be returned to the homeland in chains. ■

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The Alternate View

IT'S COMING FROM OUTER SPACE

G. Harry Stine

In December 1980 the Communications Satellite Corporation (COMSAT) announced the establishment of a new subsidiary, Satellite Television Corporation (STC), and filed with the Federal Communications Commission an application for a system of beaming television programming directly from satellites into homes.

The proposed system is *not* like current television satellite systems which relay the video signal from one ground station via a satellite to another similar ground station.

The proposed STC is what Robert P. Haviland of General Electric once called "direct broadcast satellite systems." The satellite relays the signal from a single ground station into a multitude of small ground receiving stations located atop private residences, apartment houses, Runamucka recreation vehicles, etc. The signal is broadcast to any receiver tuned and prepared to receive it.

The STC system initially would use a single satellite located in geosynchronous orbit and broadcasting a relayed TV signal to the Earth below. The receiving end of the system involves a 30-inch (0.75-meter) parabolic dish antenna mounted on a rooftop and connected to a solid-state receiver and decoder/descrambler unit whose output is then fed directly into one or more of the home's television sets.

The first STC system is expected to go on-line (FCC approval permitting) in four to five years. It would supply three channels of premium pay TV service to subscribers.

Ho hum, another pay TV system, just like cable. More drivel to feed the babble box.

Not exactly.

In the first place, there are many places in the United States where commercial TV service is brought in by microwave link or cable. Often the quality suffers because the areas of low population density in which these systems operate usually means low signal strength at the receiving antenna with accompanying poor signal-to-noise ratio.

In the second place, there are places in the United States where it's impossible to pick up any broadcast TV signal with decent strength and where land-relayed TV systems aren't installed.

A direct broadcast TV satellite system such as STC's would provide a strong, noise-free TV signal *anywhere* in the U.S.A.

It's no direct threat to cable TV in those rural or isolated areas where the population density is so low that it isn't economical for anyone to install a land-linked relay system.

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Again, ho hum, more drivel to broadcast to more people so that farmers, ranchers, and others who live out in the boondocks, by choice or by circumstances, can enjoy the same high intellectual level of thoughtful television programming impressed upon the more densely populated areas of the country.

Not exactly.

Let's take an alternate view of the concept.

First of all, it means the end of isolation if people want to buy it and if they opt to turn on their individual receivers. Regardless of how poorly one believes the video news media cover, research, and present news and other civic and instructional data, and regardless of how poor one believes the television programming is, television promotes general awareness of the current state of the world.

As I write these words, the Pope has been shot in Rome, Italy. Had I lived two hundred years ago, I wouldn't have known for months. Now I'm able to *see* what happened within hours of when it occurred. I'm more aware of the state of the world. The world importance of the event is not yet clear, and my emotional reaction to the news is not of importance to this discussion. The important element is that I knew of the event almost at once *and at almost the same time as political and religious leaders.*

If my brain doesn't know what my left foot's doing because the nerve impulse takes too long to get to my brain, or if the nerve impulse doesn't get to my brain at all, I can't walk very well.

People living in imposed isolation from the rest of the human race are running in a condition an engineer would call "open loop." If the whole human race is isolated one person from another or one culture from another, the human race runs "open loop." This dynamic condition is highly conducive to a runaway condition known as "hyperbolicity." A common feature of such systems is their propensity to destroy themselves.

How many wars have been started because of failure of communication either between the parties to the conflict or within one of the adversaries alone? I know of at least one in my own lifetime; some of the others that have also occurred may have taken place because of hypocommunication.

Direct broadcast satellites are a logical extension of communications satellite technology in the direction forecast by Arthur C. Clarke, who pointed out that, in developing communications satellites, we were in effect creating the common nervous system of mankind.

Let's take another pass at an alternate viewpoint. A satellite communication "down link" in direct broadcast television also means the eventual capability for an interactive "up link." A good receiving antenna's a good transmitting antenna. With the capability to orbit larger, more sensitive, and more powerful communications satellites, the basic STC ground equipment capable of receiving the pay TV signal from space can also, with some additional electronic gear no more complex than a CB radio, squirt a signal back to the satellite.

Then you're totally divorced from ground relay systems! You can live where you wish and remain in two-way communication with the rest of the

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world *at your own desire*. You can hook up your computer, telephone, TV set, etc., to your own personal satellite ground station and, for a price, be in touch with another computer, data bank, telephone, etc., that also has access to the satellite net. If you don't like the government postal monopoly—I did not use its official name because that name is incorrect terminology—you can follow the lead of many businesses who now utilize electronic mail service through another COMSAT subsidiary, Satellite Business Systems (SBS).

(Some computer nets already feature "bulletin boards" on which people can post messages to you and which can be recalled out of the computer network memory only through the use of your own coded signal, thus insuring privacy of communications between you and your correspondent.)

With interactive communication satellites, we'll have closed the loop, the communications net, the common nervous systems of mankind. No longer will we be *required* to operate in the open loop mode!

The consequences are staggering.

They're also frightening.

The latter is one reason why the Soviet Union has steadfastly opposed direct broadcast satellites for nearly two decades. When the Soviet government wishes to transmit a *pravda* to its people, it requires it be a Soviet *pravda* that's been properly screened, paraphrased, and slanted. It's reasonably easy to jam Earth broadcasting stations to prevent competitive *pravdas* from being received, but it's *not* easy and in some cases nearly impossible to jam a direct broadcast satellite transmission, particularly if citizens have enough technical savvy to design and build highly directional antennas. Today the Soviet Union, as well as other nations in the "Second World," are training and graduating many times more engineers than the United States. So they've got people with savvy.

For the greatest human freedom, there must also be freedom of information availability and transfer. Nobody should be allowed to tamper with the data banks. Nobody should be able to restrict access to library data banks. In this regard, the Freedom of Information Act, expensive as it's been to government and in spite of a number of mis-uses, should be extended to these satellite-based systems.

One way to do this is to insure that the service isn't free.

STC will be charging for rental or purchase of the ground station equipment, for installation of same, and for the programming service. TANSTAAFL.

Or would you rather the government pay for it out of tax money, own and install the equipment, and provide and control the programming? If you prefer this, one can recommend a place where you can go to get it.

If you have to pay for something and if you don't like it, you can stop paying for it. Sooner or later, the firm goes belly-up or caves in to competition providing what you are willing to pay for.

When you take an alternate view of something as apparently simple at first glance as direct broadcast satellites, it turns out the consequences are usually far greater than originally anticipated.

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Which is what makes this column fascinating to write, because it forces me to take an alternate view of a subject. And, hopefully, it does the same for you. An alternate view can often reveal a totally unanticipated aspect of the subject, rather like rotating a complex shape so you can get an entirely new perspective of what it really is. Remember: we don't have to agree. In fact, we should agree to disagree. According to Dr. Theodore von Karman, "How can you possibly progress without controversy?" ■

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Timothy Zahn

JOB INACTION

Any resemblance between the System in this story and reality is purely coincidental. Isn't it?

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The Monday-morning commuter into Baltimore was exactly on time for a change, and with an unexpected half-hour on his hands Charley Addison decided to walk the six blocks to his office instead of fighting the crowds for one of the golf cart-sized electric cars lined up in the station's lot. It would save his blood pressure and the shine on his shoes, and the medicomputer at the clinic had been nagging him to get more exercise, anyway.

It was a beautiful spring day, but Charley hardly noticed as he concentrated instead on plotting out his morning's work. Checking over the programming on the new chip for GM should come first, but his subordinates were good at their jobs and he didn't expect this final check to turn up any major problems. After that he'd take another shot at the submic processor that he'd been fighting with last Thursday afternoon. It was one of the toughest jobs he'd seen in his thirty-five years at Key Data Services, but it would crack eventually—they all did. Grinning in anticipation, he bounded up the outside steps of the KDS building, bade farewell to the sunshine, and went inside.

And then the universe crashed in on him.

His first indication came when he tried to call up the morning's mail on his desk terminal. Instead of the usual sender headings, the screen lit up with a terse, red-bordered message:

ACCESS DENIED.
CHARLES DOUGLAS ADDISON
8497-46-6604
IS NO LONGER EMPLOYED BY KDS.

Charley stared at the screen in disbelief for several seconds, then tried again. The same message came back. Turning the terminal off and on, he tried in succession for his last work file, the weekly cafeteria menu, and the interoffice memo file. Nothing worked. Frowning, he flipped the machine off again and headed for his boss's office.

Will Whitney, president of KDS, was on the phone when Charley walked in, a respectable frown creasing his own forehead. "Look, this may be a minor aberration to you, but it's at the catastrophe level for us," Whitney was saying as he waved Charley to a chair. "Isn't there *something* . . . ? I know, I know, but . . . Yeah, well, thanks."

Dropping the phone into its cradle, Whitney looked over at Charley. "I know why you're here, Charley. I just found out about it myself thirty minutes ago—and it doesn't look like there's anything I can do."

"Why not? Isn't this just some sort of computer glitch?"

"Of course it is—"

"Well, then, get it fixed and let me get back to work."

"—but the problem is that the report's already been transmitted to the National Employment Office. As far as they're concerned you've been legitimately fired."

Charley thought about that. "That's crazy, but even so I don't see the problem. Just hire me back."

Whitney gave him an odd look. "You haven't paid much attention to the country's employment policies lately, have you?"

"Well . . ." Charley wasn't all *that* ignorant. "I know how the unemployment system's been turned over to the

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private sector and all. But there's supposed to be a grace period after someone's fired before that goes into effect—something like ten days."

"It used to be ten days," Whitney nodded heavily. "But as the system's been improved and errors like this have become less and less frequent the grace period's been shortened—it's down to twenty-four hours now. Apparently this order went through over the weekend and . . . well, it's too late to rescind it."

A cold feeling was working its way into Charley's stomach. "Are you telling me I really *am* fired? You can't let this happen, damn it!"

Whitney spread his hands helplessly. "There's nothing I can *do*. I've talked to our lawyer and to the Employment Office people here in town—there just aren't any loopholes I can squeeze you through. If I let you on the payroll without going through the job lottery it'd be worth a felony-two fine."

Charley rubbed his hand across his forehead. "Yeah, I know. I sure wouldn't want you to wreck KDS over this—you know that. I'm just—it's not something I was expecting."

"Sure." Whitney's voice was sympathetic. "Look, we're not licked yet—maybe someone in Washington will listen to me. But . . . in case I can't get anywhere, maybe you'd better go sign up with the lottery."

Charley made a face. "I don't want to work anywhere else."

"You think *I* want you to?" was the dry response. "Aside from the fact that you know far too much about our stuff, you're just too good a man to lose. But I have to be honest about your chances here . . . and you can't live off your savings forever."

Charley stared at the floor for a moment, then sighed and got to his feet. "Yeah, you're right. I guess I'd better. I'll check back with you later."

"Yes, please do." Whitney came around from behind his desk and gave Charley a warm handshake. "Good luck."

The world seemed darker when Charley emerged onto the sidewalk. He paused for a moment, feeling a mild disorientation that seemed part of the numbness in his brain, and then turned east and began walking. He still couldn't believe this was really happening to him, that a lifetime of conscientious work could be threatened by something as meaningless as a burp in a bubble-memory somewhere.

Walking in a private fog, he almost passed right by the Baltimore branch of the National Employment Office, a modern building he'd seen often from the commuter but never entered. Steeling himself, he joined the stream of people at one of the revolving doors and made his way inside.

It was unlike anything he'd ever seen, and for a moment he stood rooted in place, taking it all in. The entire first floor seemed devoted to rows and rows of computer terminals. Each machine had a line of people waiting in front of it; around these relatively stable promontories swirled a sea of people traveling to or from other terminals or the huge display boards that lined the walls. In the center of the floor ran a pair of escalators; through their openings he could see that the second floor seemed

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laid out like the first, and was just as crowded. To his right, on the wall by the entrance, was a building directory, and Charley worked his way across the stream of people until he was close enough to read it. COMPLAINT DEPT. was listed as Room 702. Spotting a bank of elevators, he pushed his way into the crowd. Minutes later, he was on the seventh floor.

Room 702 had nothing of the wide open spaces of the ground floor, consisting instead of eight boxed-off cubicles with strategically placed upright panels directing the flow of traffic. There were about sixty people ahead of him, so Charley chose one of the shorter lines and settled down to wait. Surprisingly enough, the lines moved quickly, and within a half-hour of his arrival he was sitting down across from a tired-looking middle-aged man with frown lines stamped across his face. "Good day, Mr. Ryon—" Charley began, glancing at the desk nameplate.

"Name, number, and previous job category?" the other snapped, fingers resting on his terminal keyboard.

Charley gave them. "What happened, you see, was that I was fired accidentally—"

"Just a minute," Ryon interrupted peevishly. "Your file's not on yet."

Charley subsided. He should have expected a delay; after being at the same job for so long, his records were probably on one of the "low-use" tapes in Washington's master files, and an operator would have to be sent to get it. The way things were going, of course, his file would probably be moved to a more accessable tape on the next adjustment run.

"Says here you were terminated as of Friday, 8 May 2009, from Key Data Services, Baltimore," Ryon said at last. "That true?"

"Yes, but it was an accident —computer malfunction or human error or something."

"Should've corrected it last Saturday. Way too late now. Next!"

"Hold on! That's not fair—no one goes into work on weekends. We should be allowed one *business* day."

Ryon's frown lines deepened a bit. "The book says 'twenty-four hours.' If your boss is too lazy to pull a ten-minute computer overview on weekends, it's not our fault. *Next!*"

Charley didn't budge. "I want to see your superior."

"Forget it. I said you haven't got a case." His finger hovered over a button. "You gonna leave quietly or do we do this the hard way?"

Swallowing, Charley took the easy way.

He got off the elevator on the second floor which, as he'd surmised, was laid out like the first. For a long moment he hesitated, distaste and apprehension holding him back. But Whitney had been right; it only made sense to sign up. Picking a line at random, Charley took his place at the end.

Again, the line moved quickly. Watching the men and women at the keyboard, Charley could tell they were all familiar with this routine. Not only were they fast, but they all invariably skipped past the pages of instructions. Fidgeting uncomfortably, Charley tried to remember everything he'd ever read about the lottery.

Finally, it was his turn. Stepping up

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to the console, he pushed the "start" button.

TYPE YOUR NAME, NUMBER, AND PREVIOUS JOB CATEGORY, the machine instructed him.

Charley complied. CATEGORY/REGION? it asked.

COMPUTER PROGRAMMER/BALTIMORE, Charley typed carefully.

RANGE?

Range? What did *that* mean? Punching for the first page of instructions, Charley skimmed it and discovered the machine was asking the outer limit of his job interest. 20KM, he typed, picking a distance at random.

The machine answered with a screen full of company names, arranged alphabetically, each one followed by a string of incomprehensible numbers. NUMBER OF JOBS BEING APPLIED FOR IN THIS CATEGORY? appeared at the bottom.

Charley seemed to remember that the limit was ten. 10, he typed.

The computer's response was swift. DISALLOWED. MAXIMUM IS THREE (3).

Charley blinked. *Three?* Had they changed the law? Or was he—or programming in general—a special case? Gritting his teeth, he again called up the instructions.

The impatient rumbling behind him was growing stronger. "Hey, come on, would'ja?" someone growled. "We ain't got all month."

"Put it in 'park,' " Charley shot back, tension adding snap to his tone. "I'm working as fast as I can."

"So put in new batteries, huh?" a different voice suggested. "Sign up and let someone else have a turn."

"I'll be happy to, as soon as I figure out how."

There was a loud groan. "Aw, c'mon, friend; you hitting senility early to avoid the crowds?"

Charley felt his face reddening. "*Look*—"

"If you don't know what you're doing, go up to fourth floor and get some help," someone else put in.

Charley hadn't realized help was available. "Yeah, okay," he muttered. Pushing the "cancel" button, he stepped away, the next man in line shouldering past with a growled profanity. Too embarrassed to even turn around, Charley pushed hurriedly through the crowd toward the elevators.

Surprisingly, the fourth floor was practically deserted. Several dozen cubicles like those he'd seen three floors up lined the walls, most of them darkened and apparently empty. Of the handful that were open for business, only about half were being used. The rest of Baltimore's citizenry, Charley reflected, must have learned the ins and outs of the lottery years ago. The thought made him feel old and a little bit silly. Choosing a cubicle with a sympathetic-looking older woman, he hesitantly approached. "Uh . . . excuse me?"

She looked up, folding up the portable thin-screen she'd been watching. "Can I help you?"

"I hope so." He sat down. "I was accidentally fired this weekend, and while my boss tries to get me reinstated I thought I'd sign up for the lottery—just to tide myself over. But I'm afraid I don't understand exactly how to go about it."

"What do you mean?" she frowned.

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"Are you trying to find a new category or something?"

"No, it's just that I've never had to use the lottery before."

Her eyes widened. "You're kidding. Never?"

"I like my job." He shrugged self-consciously. "I've been there for the past thirty-five years."

That awed look was still there, and Charley felt more than ever like a revived fossil. "Wow!" she breathed. "I didn't think there was *anyone* who hadn't gone through the lottery at least once." She seemed suddenly to realize she was staring and dropped her eyes. "Well, let's see what we can do for you," she continued in a more professional tone, swiveling the terminal screen so that they could both see it. "Could you give me your name, number, and previous job, please?"

He did so. She pushed a few keys, and Charley was faced with the third page of lottery instructions.

"Right, now, first let's figure out how many jobs you can sign up for," she said, tapping a paragraph with her pen. "The longer you've been unemployed, the more job lotteries you can be in. Since you've been out of work less than a week, you can only sign up on three lists. Anything over six months and you can be on twenty of them.

"Each job list is open for sign-up for a minimum of twenty-four hours. Once it's closed, all the names on the list are put in random order by the computer and the company in question hires the first person on it for, usually, at least one four-day week."

"After interviews, you mean?"

The woman blinked. "There aren't any interviews, Mr. Addison. This is an equal opportunity system; we don't allow discrimination over educational advantages any more than over race or religion."

"But—" Charley floundered.

"It really *does* work," she assured him. "Maybe a bit slower than the old methods, but it spreads the jobs and wealth around more evenly and eliminates the need for a welfare system. And *that* saves all of us money."

She was repeating the same arguments that the developers of the system's precursor had used twenty years ago—the arguments, he remembered now, that had originally induced him to vote for it back then. It had seemed like a good idea at the time . . . but now he wasn't quite so sure. "I'll take your word for it," he told her. "What do I do next?"

"Sign up for your three jobs. Let's see . . ." She punched some keys, scanning the displays that flicked across the screen at the touch of a button. "Accounting looks pretty good today—here's a firm that has only thirty people signed up. Here's one with twenty-six."

"Wait a second—I don't know anything about accounting."

She frowned at him. "So? If they get down to your number the law says they *will* hire you for at least a week. Qualifications are irrelevant—equal opportunity, remember?"

"But what if, say, thirty short-order cooks and only one accountant sign up for the job. How is the company going to get the one they need before mid-August?"

"Oh, the law allows concurrent em-

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ployment if all parties are willing. If the accountant they want is number nine in the lottery, they'd just hire him plus the eight people ahead of him. Those eight would get their week's salary and could leave right away; the accountant would begin work in his new job at the same time. See?"

"Very convenient." Also very expensive if the right person didn't make the top ten. No wonder Whitney always looked so harried when KDS was hiring. "How on Earth do small companies survive a financial shock like that?"

"The smallest companies are exempt from the lottery." She pressed a button and a different page of the lottery instructions appeared. "And there's an intermediate range where the company can hire applicants for only one, two, or three days instead of a full week." She pointed out the appropriate numbers, then turned back to the job listing she'd had on earlier. "You ready to try your luck now?"

"Well . . . I guess so. You really think I should try for that accounting job?"

"Absolutely." She scanned the listing. "The one's up to thirty-two people; the other's hit thirty now. Only six hours to go for each one, too—unless a bunch of people notice how empty they are you should have a good shot at making some money on either one."

"How do you know about that six hours?" Charley asked, squinting at the screen.

She tapped a number with her pen. "Here's the closing date and time: May 8, 1700 hours. This column gives the opening date and time; this one's the job ID number; this one's the yearly salary; and here's the current number of people on the list. Now, what'll it be—one or both?"

Charley pursed his lips. After all, he *was* just looking for something to tide him over until he could get back with KDS. "I guess I'll sign up just on the shorter list."

"Okay." She showed him how to line up the display pointer on the proper job and then how to officially get on the list. "You've got two more chances coming to you. Any preferences?"

He chose two computer programming jobs that would also close at five that evening, ignoring her warning that with three hundred people already signed up for each one he had little hope of making any money from either of them. When he had finished, she showed him how to confirm he was properly registered by calling up his Secure Government Personal File and checking his newly acquired job list. "You can drop out of contention for any of the jobs at any time, by using the display pointer and 'cancel' key. And don't forget, once you've been out of work one to three weeks you can be on five lists at a time."

"Right." Charley made a mental note to find a quiet corner at the library later and read over all these regulations more carefully. "What do I do now?"

"Go home and wait, I guess," she shrugged. "If you've got a computer tie-in on your phone you'll be able to find out your standing on the lottery lists as soon as they close; otherwise, you can find out on the terminals downstairs. If you're high enough, the company'll contact you. If you're really low on the lists, you might as well drop out and

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sign up on a new list; you'll be automatically dropped as soon as the job is permanently filled, anyway. Any other questions?"

"Well . . . I guess not. Thanks for your help."

"Oh, no problem," she smiled brightly, shaking her head. "Imagine —thirty-five whole years in the same job."

She was still clucking with amazement as she opened up her thin-screen again and settled back to watch.

It was almost lunchtime when Charley left the National Employment Office building, feeling something like a worn-out paper towel. Not really hungry yet, he decided it would be a good time to do some research on the lottery. A municipal lot was right around the corner, with a handful of the little in-town cars still available. Presenting his driver's-credit card to the attendant, he watched to make sure it was logged correctly into the computer and then drove out of the lot, heading for the nearest branch of the venerable Enoch Pratt Library. Traffic was brisk, but with the city-wide ban on internal combustion engines finally in effect, fighting the crowds was at least no longer a suffocatingly noisy task. Remembering the city of his youth, Charley's irritation at the government eased somewhat. Occasionally, their schemes made life a bit easier.

He emerged from the library about two hours later, slightly boggled at the number of laws and regulations the lottery had generated over the years and completely discouraged as to his chances of finding a loophole he could use. His one half-formed idea—that of setting himself up as a one-man "consulting firm" which KDS could exclusively retain—was scotched early in his reading, and he hadn't been able to come up with anything else that offered even a spark of hope. The National Employment Office had had two decades to close the loopholes, and they'd done a good job. Squinting up at the early-afternoon sun, Charley flipped a mental coin. Lunch lost; climbing into his car, he headed back to KDS.

Will Whitney was off somewhere when Charley arrived, but was expected back momentarily. "I'll wait," Charley told Whitney's secretary. "I haven't got much else to do."

"I heard," she said sympathetically. "We're all pretty upset about it. I hear the people in Programming are missing you already."

"Thanks," Charley grunted. "It's nice to be needed."

Whitney barreled through about ten minutes later. "Charley, hi; come on in," he called as he passed.

"I just stopped by to see if you had anything new," Charley said as he sat down across from Whitney's desk.

"Afraid not," Whitney said distractedly, shuffling through a mound of papers on his desk. "Damn GM chip's got a glitch in it Sanders can't find. Did you give me the preliminary stat sheet yet?"

"Last week," Charley told him. "Look, why don't I go and give Sanders a hand with the debugging?"

"Great. No—wait." Whitney looked up, frowning. "No, you'd better not. I mean, you're no longer on the payroll. . . ." He trailed off.

"You don't need to pay me," Charley assured him. "Come on, Will—I

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want to help. Consider it a public service to keep my brain from atrophying."

"Believe me, I wish I could let you. But . . . I don't think we can risk it. If someone found out—I mean, there's no way we could prove I wasn't going to pay you under the table."

Charley sighed. "Yeah; and then blam goes a big government fine. I suppose you're right." He stood up awkwardly. "Well, then, I guess I might as well go on home."

"Okay." Whitney had found the paper he wanted. Clutching it, he headed for the door, his free hand sweeping Charley along with him. "Look, I'm still trying to get you back, so keep in touch, okay?"

"Right." Standing in the corridor, Charley watched his boss—his ex-boss—hurry away. Feeling vaguely as if he'd just lost part of his family, Charley turned and trudged toward the exit. A short time later, having turned in his car to the lot at the train station, he was on his way home.

At exactly 5:01 that evening he keyed his phone's computer tie-in and, holding his breath, checked his standings. The list for the accounting position had swelled to one hundred seventy-six since he'd signed up; the computer job rosters hovered near the five-hundred mark. On none of them had he even made it above a hundred.

The next few days settled easily—too easily—into a dull routine. Each morning Charley headed into the city—cursing the fact that the job lottery wasn't accessible from home tie-ins—and fought the crowds at the National Employment Office building. After a few disappointing experiences with the high-paying jobs that attracted lots of applicants, he became adept at flipping through page after page of job listings, scanning for medium-paying ones that were being largely ignored. As a matter of pride, though, he made sure he was always listed for at least one computer-oriented job, even though they were generally long-shots. Once signed up, his "work" was done for the day. At first he spent his new free time constructively; catching up on all the journals he'd been promising himself to read, working out at the fleeball courts, and carrying out needed maintenance on his condo. But as the days went by he found himself drifting from self-improvement toward self-indulgence. The trend didn't worry him particularly; sitting in front of his wall thin-screen, he told himself that things would be all right again once he was back at work.

And exactly one week after losing his job, a break finally came. Not the one he'd hoped for, but a break nevertheless.

The receptionist at Dundalk Electronics looked up as Charley came in. "May I help you?" she asked pleasantly.

"My name's Charles Addison; I'm here about the programmer job."

"Down the hall, second door on the right," she said, her voice noticeably cooler.

"Thank you." Wondering what he'd said, Charley left the room and headed down the corridor.

The sign on the door said Employment Office, and the young man behind the anteroom desk had the busy look of a man clawing his way up the corporate

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ladder. "Yes?" he said as Charley stepped up. "Name, please?"

"Charles Addison. I was called yesterday—"

"Right." The junior exec took a piece of paper from a stack beside him and handed it over. "Sign it and you can have your chit."

Frowning, Charley took it and read the first paragraph. It was a contract stating that he was withdrawing from the lottery for job #442-0761-3228-764 in exchange for a cash payment. "I think there's been a mistake," he said. "I'm here about the programmer job."

The other looked up, mild irritation on his face. "And there's your release. Sign it and you'll get your money."

"But I don't want any money—I want the job."

The younger man stared up at him in disbelief. "What are you trying to pull?" *he demanded.*

"Nothing. But I'm number eight in the lottery and I'm qualified for the job, so I'd like to take a shot at it."

"But—" the other sputtered. "You can't; we've already hired the woman we wanted."

"Then why did you call me?—wait a minute. What was her lottery number?" Anger was beginning to grow in Charley's mind; anger and a conviction that someone was trying to cheat him. "Well?"

The junior exec hesitated, then took refuge in his intercom. "Mr. Girard; there's someone here I think you'd better see."

A moment later the inner door opened and a broad-faced man strode into the anteroom. "Yes? Is there some problem?"

"This man refuses to sign the lottery release," his subordinate said, pointing at Charley.

Girard's eyebrows rose fractionally. "Is that true, Mr.—?"

"Addison; Charles Addison. Yes, it is. I've worked in computers since I was twenty-three, and I want to take this job."

"I see. Would you step into my office, please?"

Charley followed him inside, sat down in the proffered seat. "Now, Mr. Addison," Girard said, perching on a corner of his desk, "I'm sure you understand the computer industry these days; how fast things are changing and all. I don't doubt you're an excellent worker, but we need someone fresh from the leading edge of research in the field."

"Mr. Girard, you don't seem to understand. *I'm not just someone who* wandered in off the lottery—up till a week ago I was chief programmer at Key Data Services. I *know* I can do the job."

"Yes, I'm sure you could—with proper training. But we can't afford to take the time."

"Not even a week? I'm legally entitled to a week, you know."

Girard shrugged. "Quite frankly, Mr. Addison, you'd be wasting both your time and ours. The higher-ups have already decided who they want, and they would be the ones to decide whether or not your work had been satisfactory."

Charley stared at him. "And it wouldn't be, of course," he said bitterly.

The other spread his hands. "It's

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standard company policy, designed to speed up the employment process. I'm sorry, but there's nothing I can do."

Charley grimaced, a sour taste in his mouth. This was something his reading hadn't prepared him for, and he didn't know how to fight it. Suddenly realizing he was still clutching the release form, he raised it and began reading. A number caught his eye. "This says you're only going to pay me three hundred fifty to drop out of the list. A week's salary for a twenty-five-kay job should be five hundred, shouldn't it?"

"Oh, well, that's standard policy, too. You see, if you're actually hired for a job, even concurrently and only for a week, you lose your build-up of unemployed time. Most of the people we pay off are up to the twenty-listing level and don't want to start over again at three. They're willing to take less money to simply drop out of line and therefore maintain their status."

A status that apparently enabled them to avoid work entirely while still making money. The welfare system hadn't died, Charley realized; it had merely been given plastic surgery and sent out under a new name. "Cute. Probably legal, too."

"Of course." Girard reached into his pocket. "So if you'll just sign the agreement—"

"But I'm not one of your professional moochers," Charley interrupted him. "I prefer to work for my living, even if only for a week at a time."

Girard froze halfway through the motion of handing Charley a pen. "I . . . well, I suppose that would be all right. I guess your status doesn't matter much when you've only been out a week, eh? I'll just get a concurrent-employment agreement—"

"That's not good enough," Charley said calmly. The rules of this game, he was learning, were far different than he'd expected. It was time to find out if they would bend for *him*, too. "Maybe working here *would* be a waste of time—but I've got plenty to spare. If you and your new whiz-kid don't want to sit around for a week, you'll have to make it worthwhile for me to drop out."

Girard's eyes narrowed. He was silent a long moment, searching Charley's face. "How much?" he said at last, some of the starch seeming to go out of his backbone with the words.

Pay dirt. Anticipating business as usual, Dundalk Electronics must have jumped the gun. Their new programmer was probably hard at work already—and Charley was suddenly in a strong position. Maybe. "I want two weeks' salary," he told the other, daring greatly. If Girard called his bluff and refused, Charley wasn't at all sure he could get official attention to the case—or even whether the government really prosecuted cases like this.

But Girard didn't refuse. "Wait here," he growled and left the room. Within two minutes he was back with an electronic transfer chit and a new form, both of which he thrust at Charley. Skimming the paper, Charley learned he had accepted a week's concurrent employment at a "special payment rate" of a thousand dollars. The chit was made out in the proper amount; pocketing it, Charley signed the agreement.

"Okay. Now get out," Girard growled as he took back the paper.

Charley stood up. "I don't want you

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to think I'm deliberately trying to cheat you," he said. "As far as I'm concerned, you're entitled to two weeks' worth of my services. I'm sure I could be of help around—"

"Forget it. And if you ever wind up on one of our lists again, don't think you'll be able to pull this trick twice. Troublemakers like you go onto our computer, and it carries grudges a long time."

"I'll keep that in mind. Good-by, Mr. Girard."

It was a small victory, Charley realized as he walked outside, and not one he was particularly proud of. Still, getting paid for not working was the next best thing to actually having a job. He just hoped it wouldn't get to be a habit.

"Will, I'm rapidly going nuts. Isn't there *anyone* else you can try?"

Whitney's face, even given the limitations of telephone pictures, looked pretty haggard. "I tell you, Charley, I've gone the whole route. I've talked to everyone in the local Employment Office and half of the button-pushers in Washington. Apparently no one but the director himself can do anything at this point, and he's already refused to intercede. Ignores my letters and calls completely now."

"Maybe you should write to the president," Charley suggested, only half-jokingly.

"Of the United States? I already did. Also the Secretary of Labor. They each sent me back a form letter and list of the administration's accomplishments." Whitney shook his head tiredly. "Look, if you need to borrow some money or something—"

"Aw, no, it's not that," Charley assured him. "I'm making a little bit now and my savings account is still healthy. I just can't stand this business of collecting money for doing absolutely nothing. I thought I'd get used to it, but I'm not. How do people do this for years at a time?—five weeks and already I feel like a cross between a parasite and a professional gambler."

"Have you tried for any government jobs? They're mostly low-skill, low-pay types, but at least you'd be working for your income."

"I'd rather sweep floors for private industry, if it comes to that. Look, Will, if we're stuck, we're stuck. Let's open up the job, and I'll just take my chances with the lottery."

"Well . . ." Whitney seemed acutely embarrassed. "It doesn't look like we can afford to do that. The law limits how much internal shifting we can do when a position is vacated, and it turns out that the lowest job we'd be able to offer on the lottery would be that of level-two programmer. With the thirty-three-kay salary that goes with that we'd get hundreds of applicants, and we can't possibly afford to pay off even a fraction of them. We're just going to have to make do with one less programmer for a while."

Charley felt his jaw sag. "But if you don't even open the job up I won't have *any* chance of getting it back."

"I'm sorry, but we've got no choice. We'd give practically anything to have you back—you know that. But we can't go bankrupt in the process."

"Yeah. Yeah, I understand."

"Again, I'm sorry. If you can come up with any new ideas, I'm game to try

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them." Whitney glanced away as someone apparently came into his office. "I've got to go. Keep in touch, okay?"

"Sure. Good-by."

For a minute after the connection was broken Charley remained where he was, staring through the blank screen. The hope of eventually getting his job back was all that had kept him going these past few weeks. He couldn't—*wouldn't*—give that up.

So the director of the National Employment Office wasn't answering calls and letters, eh? Well, there was always the direct approach. Flipping on his computer tie-in, Charley called up the Baltimore-Washington train schedule.

"Mr. Addison, there really isn't any point in waiting—really," the secretary said, her manner one of polite irritation. "Director Pines *never* sees anyone without an appointment."

"I understand," Charley told her from his seat by the reception room door. "If you don't mind, I'll wait a bit longer. In case he changes his mind."

She sighed and returned to her typing as Charley buried his nose in his magazine again. It was clear that Pines's refusal to see him wasn't merely general policy; the secretary had been in and out of the inner office twice since Charley's arrival, and he had no doubt that the director knew of his presence and business. Equally clear was the fact that Pines wouldn't be coming out through the reception room as long as Charley was waiting to buttonhole him. But if Charley had judged things correctly the director had a private door into his office—a door just within view from Charley's carefully chosen seat. Trying to avoid him was the director's prerogative, of course—but it was almost noon, and Charley doubted Pines had his lunch in there with him. Pretending to read his magazine, Charley gave the private door his undivided attention.

And minutes later his diligence was rewarded as the door opened and a dignified-looking older man slipped out. Dropping his magazine, Charley charged out after him, catching up before the other had gone ten steps. "Dr. Pines? My name's Charles Addison."

Pines glanced at Charley with a look of extreme annoyance and increased his pace. Charley stayed with him. "Dr. Pines, this isn't a problem that'll just go away if you ignore it long enough. I've been cheated out of my job by your system, and I'm not going to give up until I've got it back. Now, are you going to discuss it with me, or am I going to have to follow you all over town?"

With the explosive sigh of barely restrained exasperation Pines stopped abruptly and faced Charley. "Mr. Addison, your complaint was brought to my attention weeks ago," he said, his words precise and clipped. "As I explained to your employer then, the law is *very* clear on the subject of error correction: twenty-four hours—no more—is the time limit. Period; end file; good day."

He started walking again. Charley hurried to catch up. "I don't think that's at all fair, Doctor," he said, "and for a system that bills itself as the first truly fair employment scheme in modern history something like this would be an ugly blot, wouldn't it? How would you feel if the news media got the story?"

Pines didn't even break stride. "To

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quote the Duke of Wellington, publish and be damned."

So Pines was the type to call bluffs . . . and Charley had already tried vainly to interest the media in his situation. "*Hell,*" Charley exploded, his self-control finally breaking. "Look, I've worked and sweated for thirty-five years at a job and company I've really grown to like. I'm a good citizen, I pay my taxes on time, and I've had jury duty twice. Why the hell would it be such blasphemy to bend the rule *just once?*"

Pines stopped again. "Because it wouldn't *be* just once," he snapped. "If I let *you* bypass the rules there would be hundreds of people who'd demand the same privilege, whether their claims were justified or not. A flood like that would cost tremendous time and money, and ultimately hurt both the lottery system and the taxpayers and businesses that support it. It's not worth that kind of risk for *any* job, Mr. Addison—not yours, mine, or anyone else's. If you've been dealt with unfairly, I'm sorry—but I am *not* going to change anything. Understand? Good *day.*"

He strode off down the hall with a snort. Charley watched him go, his mind numb with defeat. He'd gone to the very top . . . and come away with absolutely nothing.

The train ride back to Baltimore seemed very long.

He stayed in his condo the next three days, not even coming out to register with the lottery. A great deal of his time was spent staring out the window in deep thought: thought about his past and future, and the things various people had said lately about both.

Perhaps he should just give up and find a permanent job somewhere, even if it weren't in programming. Whitney's comment about the low demand for government jobs kept coming back to him, but the thought left him cold. Even if he couldn't work at KDS, he at least wanted a job in computers somewhere. But after his experience at Dundalk Electronics he wondered if *any* programming firm would hire him, or whether they all preferred fresh new college graduates. And to be honest, he was afraid to find out. In some ways it was infinitely safer to stay on the lottery's pseudo-welfare.

Still, something inside him refused to give up . . . and when he woke on the fourth day he had the first faint glimmerings of an idea. Incomplete and even slightly crazy, it was nevertheless all he had left. Getting dressed, he took the next commuter into Baltimore.

It took him ten minutes at a terminal to locate and sign up for all the jobs he could in the proper class. All of them fizzled out by day's end; but the turnover was high, and there was a new crop of them waiting for him the next morning . . . and the next. Doggedly, he kept at it.

And within a week he was in. Job description: maintenance engineer, custodial; evening/weekend shift. Employer: U.S. government. Job location: National Employment Office Administration Building, Washington, D.C. Salary: not worth mentioning.

The National Employment Office had never had a new building designed for it, but had from its beginnings been housed in a century-old structure whose

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masonry and vaulted ceilings clashed curiously with the ultramodern computer equipment that had been more recently installed. Charley had noticed the contrast on his last visit here—but he hadn't expected the janitorial equipment to match the building's age. The sweepers, waxers, and one genuine monstrosity of a floor buffer were older than they had any right to be. Pushing them around every night was harder work than he would have guessed, and he quickly learned why these jobs changed hands so often.

The soreness generated in Charley's muscles by two nights on the job would be short-lived, though. His supervisor had already made it clear that Charley's first three-day weekend on the job would be his last. No reason aside from "unsatisfactory performance" was given, but Charley could see Director Pines's hand behind it. With the high turnover rate, Charley wouldn't have had to stick with the job more than a month or so to work his way up to field boss—a position that would give him keys to the private as well as public areas of the building. After their last encounter, Charley couldn't blame the director for not wanting that to happen. And that meant that Charley's move had to be made tonight.

"Hey, Addison," a voice came faintly over the floor buffer's roar, breaking into Charley's train of thought. Flipping the buffer off, he turned as Lanthrop, his field boss, sauntered up behind him. "I hear this's your last night," Lanthrop continued when the machine's big motor had ground down far enough to permit normal conversation.

"Yep. Back on the lottery tomorrow, I guess," Charley said.

"Too bad. You're a better worker than we mostly get here. Haupt's crazy to send you back."

Charley shrugged. "That's life."

"Yeah. Hey, what say we all go out at break time; treat you to a bottle of the good stuff or something. You know, give you a proper send-off."

"Fine—but we won't have to go anywhere. I figured that you guys've been such a big help to me that I owed you one. I won a bottle of the *really* good stuff in a bet the other day, and I brought it along tonight."

Lanthrop's eyes lit up. "Hey, that sounds great. Matter of fact, it sounds so great that I declare it to be break time right now. C'mon, let's get the others."

"I'll do that," Charley volunteered. "Why don't you go on and—um—make sure the stuff's up to your standards. It's in my locker."

With a wide grin, Lanthrop winked. "*Damn*, but I'm gonna hate to lose you."

Charley took his time collecting the other seven custodial workers, and when they arrived downstairs they discovered Lanthrop was well ahead of them. "*Great* stuff, Addison—got a real kick to it!" he called cheerfully, his speech already beginning to slur.

"Sure does," Charley agreed as they all sat down around the table. It ought to, he thought wryly; the bottle had been only two-thirds full of bourbon before he'd filled it up with straight ethanol.

The other workers joined into the spirit of the occasion with remarkable speed. Passing the bottle around the cir-

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cle—a method that allowed Charley to keep his own consumption to practically zero—they were soon laughing and talking boisterously, wishing Charley good luck in the days ahead. Charley joined in the laughter, and kept the bottle moving.

Lanthrop had a reasonable capacity, but with his head start he was roaring drunk before anyone else was even close, and by the time someone suggested it was time to return upstairs he was sprawled in his chair, slumbering peacefully. Assuring the others he would take care of the boss, Charley waited until they had staggered out, and then set to work. Settling Lanthrop into a more comfortable position, he relieved the field boss of his master keys, replacing them with his own public-area set to keep the loss from being too obvious. His next task took him to the main file room, where the employment records and resumés of every worker in the nation were stored on huge reels of holo-magnetic tape. This was the riskiest part of his plan—the file room connected directly to the main computer room, and the dozen or so operators on duty had a fair chance of knowing that Charley wasn't authorized in there. Fortunately, the reels he wanted were "low-use" ones stored in the racks farthest from the computer itself, and he was able to pull the three he wanted without being seen. Back out in the hall, he hid the tapes in the bottom of the garbage container on his wheeled cleaning-supplies cart and, heart pounding painfully, pushed it down the hall as casually as his shaking knees would permit.

Now came the waiting. From conversations with others, he knew that Director Pines invariably arrived early on Monday mornings, usually before the night shift was due to check out. If Charley's luck held, this would be one of those mornings.

It was.

Pines was four steps into his office before he noticed Charley sitting quietly by the wall. "Who are you?" he asked, stopping abruptly, apparently too startled for the moment to be angry.

Charley remained seated. "I'm Charles Addison. We met a couple of weeks ago."

The mental wheels visibly clicked into place. "Why you—you—" he sputtered. "Get the hell out of my office—you hear me? Now!" He stepped forward menacingly.

"Before you do anything drastic," Charley suggested, "you ought to take a look over there in the corner."

Pines came to an aburpt halt. "My tapes!" he exclaimed, the first hint of uneasiness creeping through his anger. "What are you doing with them?"

"Engaging in an old custom called blackmail," Charley told him, glancing at the pile. It *was* an unusual sight, he had to admit: three tape reels—minus their protective casings—stacked neatly beneath the old floor buffer. "Magnetic tapes have come a long way in fifty years, especially in storage density, but they still have an unavoidable weakness: they're susceptible to strong electromagnetic fields. That thing on top is an old electric floor buffer. It packs a huge electric motor."

Pines understood, all right. Already his eyes were flickering between the

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tapes and Charley, clearly wondering whether he could beat Charley to the buffer's switch. He was bracing himself to charge when Charley raised his hand, showing the director that he held the machine's plug. "The buffer's switched on already," he explained. "All I have to do is plug it in. You can't possibly reach either the tapes or me before they're ruined, so you might as well sit down and relax."

"You're insane," Pines muttered as he sank into a nearby chair. "You can get twenty years for sabotaging government property like this."

"So far nothing's been damaged," Charley assured him. "You're right, of course, I'll be in big trouble if I plug this in. But have you considered what'll happen to you?"

"What do you mean?"

"Your security's gotten pretty lax. I got into the file room without any trouble, picked up these tapes, and just walked out with them. That's going to make your department look pretty bad."

"You couldn't have taken them out of the building, though—there's an alarm-trigger built into each of the reels."

"Oh? I didn't know that. But that hasn't prevented me from threatening them here in the building itself. I wonder what your bosses at the Labor Department are going to say."

Pines was beginning to look worried, but he still had plenty of fight left in him. "They won't say much. The tapes you've got can be reconstructed, surely. No security system is perfect—they know that. *You're* the one in trouble, not me."

"I'm sure most tapes *would* be easy to reconstruct," Charley nodded. "With the job market shifting so often, I imagine ninety percent of your master tapes are duplicated at any given time in the thousands of temporary bubble storages you've got in the local offices around the country. But I'll bet that some of the files on *these* three aren't. Don't you want to know which tapes I've got here?"

Pines's eyes flickered to the pile. "All right—tell me."

"They're the complete records of some people who haven't gone through the lottery for a few years now: the President, Cabinet, Supreme Court, most of Congress, and the top people in the Foreign Service, military, and federal judiciary. If I plug this in, you'll have to go to every single one of those people and ask for access to their Secure Personal Files to get the information back. Still think your bosses won't say anything?"

Pines went white. "No!" he hissed. "You wouldn't!"

"That's entirely up to you. You get me my job back at Key Data Services and no one will ever hear about this from me. I'll walk out that door and you'll never see me again."

"At least until you start demanding money," Pines said bitterly.

"With a twenty-year jail sentence hanging over my head? Don't be absurd. Besides, what would I blackmail you with—the use of your legitimate authority to correct an error?" Charley shook his head.

"But the rules—"

"—aren't in charge here: you are. And you're here *because* the rules don't adapt to these unexpected changes, to

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things that *shouldn't* have happened but did anyway. If they could—if computers could balance justice and mercy—you wouldn't be needed. As it is, a system like the National Employment Office couldn't exist without you—it would have been torn apart years ago."

For a moment Pines gazed into space. Then, with just a glance at the tapes, he stepped over to his desk terminal. "What was the name of that company again?"

And Charley knew he'd won.

"Frankly, Charley, I never expected to see you at this desk again—but I'm damn glad I was wrong," Will Whitney said, smiling like his face was going to split.

"Me, neither," Charley agreed, savoring the feel of his old chair as he gazed at the piles of work on his desk. "I'm glad to see you can still use me. I was half afraid Sanders would've completely taken over by now."

"You kidding? He's happier to have you back than I am." Whitney shook his head. "I'd never realized before how indispensable you are to KDS. I'm glad you found someone in Washington who agreed."

Charley grinned. "That's the whole secret of success, Will. You can accomplish a lot when someone thinks you're irreplaceable." And even more, he thought wryly, when he thinks that of himself. ■

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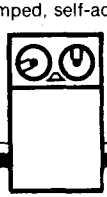

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By Spider Robinson

Voyagers, Ben Bova, Doubleday, 408 pp., $14.95
Imaro, Charles R. Saunders, DAW, ? pp., $2.25
Fireflood and Other Stories, Vonda N. McIntyre, Timescape (Pocket Books), 240 pp., $2.75

CODA

The Dean of Men was sure he had me that time; the evidence was circumstantial but most persuasive. I could offer no coherent explanation for the presence of 1,440 empty Jello boxes in my dormitory room, and they represented the same spectrum of flavors to be found in my resident advisor's room between floor and transom. But certain faculty members intervened in my behalf, and my grades were good, and I went so far as to remove my beard and shorten my hair; I left the hearing with the assurance that I would, after all, be permitted to remain safe and snug in the academic womb-bag—for as long as I could refrain from jobbing rooms (or at least from getting caught at it). In a happy daze I wandered through the streets to the home of Big Bill Dunn, who had that day married his sweetie Jo Ann; the wedding celebration was in full swing when I arrived. As I cleared the door I saw him, a heavily forested mountain of a man, red curls spilling all over the absurd tuxedo, a grin across his face like the front end of a Buick. Bill is a poet and a scholar of classical languages and world literature; I once saw him jump off the back of a pickup with a refrigerator in his arms. When he saw me his face changed as he recalled my situation—then he saw my goofy grin, realized I'd gotten clear somehow, and his own smile returned even bigger. He came to me, stuck a quart of Metaxa in my hand, put a drinking straw into the quart, and boomed these words: "My son, I perceive that a great express-train has been lifted from your testicles." And then he hugged me in those great arms.

That metaphor has remained in the back of my memory all the years since, and now today I hear again the jolly baritone of Big Bill Dunn. A veritable Orient Express is even now being connected to the winch, and already I breathe a little easier in anticipation.

I'm getting out of the book review business. This will be my last column for at least a year or two, perhaps forever.

I do this with a good deal of hesitation. Hell, I've been hesitating for five years now, since I got into this racket. I started out doing twelve columns a year for *Galaxy;* after a few years I noticed that reviewing took up about three weeks of each month, leaving one week in which to chop firewood, haul water, change diapers, cook dinner, tighten up the roof, and—oh yes—write novels and stories. I cut back to ten columns a year: four for the quarterly "paperback-bookazine" *Destinies* and six for *Analog,* alternating with Lester del Rey. The two months' vacation was welcome; to extend Bill's metaphor, it might be said that a couple of cars were

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uncoupled from the express train. Pay copy started to pile up next to the typewriter: stories, novel proposals. After a year I gave reluctant notice to Jim Baen at *Destinies,* and now I was down to six a year; I had time to edit an anthology and arrange for the publication of a posthumous Edgar Pangborn collection. When Doc Schmidt took over the helm of *Analog,* I told him I was not anxious to do more than four columns a year. This past year I have published the anthology and two short story collections, sold four stories and two articles, and all but completed a large novel. A pattern has become apparent, and those last three-cars-and-a-locomotive have just got to go.

Here, in no particular order, are the reasons why I've held on so long:

The free books. Books I could never have afforded in hardcover, big art folios, books I might not have gambled on even at paperback prices.

The exposure. Lots of people have been exposed to my name, and may recall it when next they pass the bookracks.

A letter from a blind fan. He had obtained and read a book which I had enthusiastically recommended. He had read it with the aid of a device called an Opticon. It scans print *one letter at a time,* pokes you in the thumb with little pins arrayed in the shape of that letter. It costs about as much as a really good used car. The man told me that it had taken him three and a half weeks to read the book I'd recommended, and that he had found it to be indeed worth the effort, and he thanked me.

The opportunity to sound off, to provide in some small measure a kind of antidote to some contemporary SF criticism. When many of the louder voices discussing the field are talking through their hats, there is a great satisfaction in saying so publicly.

A letter from a reader who stated that he always enjoyed any book I panned, and disliked any book I recommended. Oddly enough, he was complaining about this, though I fail to see how a reviewer could possibly have been a more reliable buying guide for him. But he cheered me up, encouraged me to persevere.

The occasional advance look at a really special book. This happens much less often than you might guess: most hardcovers and paperbacks are sent out for review on or shortly before publication. But once in a while I get galleys for a new Heinlein or Niven or Pohl well in advance of publication, and you have to have had a lifetime of knowing-there's-a-new-Heinlein-out-but-having-to-wait-for-the-paperback to understand how really good that first-kid-on-the-block feeling can be. On the strength of my reviewer's credentials, I was able to sneak my daughter into an advance press screening, making her the first kid in Maritime Canada to see *The Empire Strikes Back;* that felt some good. I've had a look at a Varley screenplay for "The Phantom of Kansas," which I am certain will never be produced because it is much, much too good; I'm sorry you won't ever see it, but I'm glad I did.

A letter from the aforesaid Herb (John Varley's friends call him Herb, pronounced with a hard "H") thanking me sincerely for a sharp criticism of his then-current novel, which Herb felt was well taken. That man will definitely go far.

A letter from Dave Bischoff, responding *most* politely to some sharp criticisms which he did *not* feel were well taken. Writers, in my experience, almost never respond to a bad review; when they do they are usually inco-

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herent with rage.* Varley, Bischoff, Budrys, and Sprague de Camp are the only exceptions I can recall offhand, in nearly six years of reviewing. On the other end of the spectrum, a writer once sent me a blistering commentary on a *favorable* review. (Me, the first review I ever got was a pan from Lester del Rey in this very magazine; I made a point of looking him up and thanking him personally. I'd much rather be panned than ignored; there'll always be readers who feel like the gent mentioned three paragraphs ago.)

The abundance of firestarter, which book reviewing provides for woodstove or fireplace.

A letter from a man who said he had bought a bunch of Edgar Pangborn books I plugged, and read them all, and decided not to commit suicide after all.

The regular pay. It ain't much, and it ain't often, but it's *regular* (at least, it has been at *Analog* and *Destinies*). If you deliver a novel in May, you might get lucky and see the check before fall—but don't bet the farm. Whereas review-column money is so small it earns negligible interest, and might as well be paid. Pitiful as it is, it is the only income I can count on.

The great privilege of calling Stanley Schmidt and chewing the fat. His is a supple and stimulating mind, which I have admired since I favorably reviewed a novel of his, *Newton and the Quasi-Apple,* in the very first review column I ever did, lo these many moons ago.

The pleasure and prestige of being associated with *Analog*.

Now here are the reasons why those reasons are no longer enough:

Science fiction overdose. It doesn't seem to matter how long an interval I arrange between columns—if I allow myself to read more than one non-SF book a week, there won't be a column's-worth read by the time deadline rolls around. I have a massive stack of non-SF books I've been saving, and I want to get my teeth into them.

Bad science fiction overdose. Sure I get tons of free books—but most of them are overpriced. I am *not* saying that the overall quality of SF is getting worse. But by Sturgeon's Law, ninety percent of the SF published at any given time reminds one sharply that "sci fi" is the plural of "scum fum." 'Twas ever thus, and for *you* it is a temporary problem: you are confronted with the more obvious crud for only as long as it takes you to select something that looks promising and scamper home with it. I've got it *all,* all that trash from the bookrack, right here in my home, and what am I to do with it? I can't give the stuff to hospitals—it would be immoral to expose helpless, drug-sodden, pain-wracked patients to mindrot. Can't give it to libraries; I'd turn off hundreds of potential converts to SF—I want my library to have a high-quality SF section, and I will not lower the average. The two used-book dealers in town are pals of mine—I cannot unload crud on them and continue to eat their salt. It's embarrassing to have it around the house; I have to keep steering guests away from it. My garbage man, a large individual with hair growing out of his fingernails, has already indicated clearly that that'll be enough with the friggin' bags of friggin' books already. My most recent

*Who was the composer who sent the following letter to a vicious critic? "Dear sir: I am seated in the smallest room of my home. Your review is before me. Shortly it will be behind me. Very truly yours . . ." Now, that's class. If someone reacted to one of my columns that way, would that make his copy of that issue an AnalLog?

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landlord did his very best to help, by failing to deliver heat for extended portions of a Halifax winter, but even a woodstove with good draft and a fireplace and a Halifax winter cannot make a dent in the world's supply of bad science fiction. I can't get near my desk; I'm typing this on the dining room table, and I have begun to have nightmares about smothering under a vast stinking heap of wretched SF and pseudoSF and naked slavegirl fantasies and ignorant critical tomes and Bermuda Triangle exposés and UFO books and emetic epics, trilogies and tetralogies and googologies of them. . . .

Bad non-science fiction overdose. When you get on review lists, some houses send you everything. Nurse romances. Puzzle books. Dusters. Soft pore corn. Steaming miscegenation on de ol' plantation. Other publishers send you their season catalog, and ship only what you request. This is even worse, for two reasons. First, it adds so much turnaround time that you end up getting the review copy *after* publication. Second and worst, you have to read the catalog, which I always find uniquely enraging. Pages and pages of full-page, four-color breathless hype for the books the publisher is really proud of, the lead titles, the flagships of the fall line—stuff so utterly fecal that even *National Lampoon* could not parody it. Then a few pages of children's books, coffee-table books, gardening manuals, and . . . a single, final page with four SF titles, giving title, author, ordering data, a two-sentence blurb and a cover shot the size of the new postage stamp for each book. No special discount for bulk orders. No display racks. No author's promotional tour. No TV and radio spots. One publisher forgot to list a major SF novel in its catalog until it had been on the mainstream bestseller lists for two months. It is irritating to be continually reminded that your books would be heavily promoted and flogged if only they were shit.

A sudden and drastic hour shortage. My wife Jeanne has, after years of monumental effort, succeeded in birthing a professional performing modern dance company here in Halifax (called Nova Dance Theatre); they make their national debut at the Dance In Canada Conference next month. I'm chairman of her board of directors, a redoubtable group, and if you know anything about the economics of modern dance in Canada you will understand why I am busier than a one-eyed air traffic controller these days. In addition, I want more hours to spend with my daughter, Now That We Are Six.

The surprising number of enemies I seem to have made. Apparently a goodly number of writers, even ones old enough and smart enough to know better, equate an unfavorable review with a punch in the mouth. Perhaps they suffer from the delusion that reviews affect sales (if that were true, Edgar Pangborn would have died rich, and Heinlein's last three books would have died in the stores); perhaps they are so insecure that they divide the world into worshippers and assailants. Regardless, I fart in their general direction.

The surprising number of friends I've made. Surprisingly low, that is—at least I was surprised. It seems most writers are convinced that a favorable review is only what they deserve. I'm thinking of one writer in particular, whom I mentioned earlier; I gave him three successive raves—then in the fourth review I decided it was time to demonstrate some critical objectivity and picked *one* minor nit. That's the review he responded to—and his response spoiled two rolls of film that arrived the same day.

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(In connection with the two above, I wish that more writers would emulate the wisdom of Samuel R. Delany. Chip once said that when he reads a killer review of his work, he gets depressed and can't work for two days; when he reads a rave review of his work, he gets euphoric and can't work for three days; consequently he has stopped reading his reviews. I read my own notices, but I try to take both the good and the bad *well* salted. In my wife's business a bad review can cost you a year's operating grant—but if a science fiction review can affect a book's royalties by as much as twenty bucks either way, I can't prove it after six years in the business.)

The boxes and boxes full of letters from people who read this terrific story once about a spaceman on a purple planet, and could I please tell them title, author, and most recent anthologization?

The boxes and boxes full of letters from people who want me to help them get their altogether wonderful novel published, through my "influence with the publishers," or who want a "real short, two- or three-page course" in how to write.

The boxes and boxes of letters so thoughtful, kind, helpful or entertaining as to demand a reply which I haven't got time to make. Few things make you quite as guilty as a nice letter you can't answer. So you put it aside for later, and one day there are boxes and boxes of them.

Finally, and worst of all:

The damned delay lag. I am a reviewer, not a critic. What I have tried to do with this column is to be a weathervane of known biases by which you can compute how to spend your science fiction dollar. I have no interest in discussing books which are no longer on the shelves. But review copies are sent out so close to pub date that I can no longer get a review into print before the book goes off-sale; even the few galley proofs and bound galleys I get have been arriving later and later in recent years, while magazine lead-time has been steadily increasing. About year ago, in desperation, I published a notice in several of the trade journals, offering to accept for review manuscript photocopies of any professionally sold SF book, in an attempt to beat delay-lag. This worked out even worse than I had expected, which is considerable. When an author has invested twenty bucks in photocopying and postage, and when ninety percent of those who do turn out to be beginners who can ill afford it, I feel *terrible* putting the pile quietly down after ten pages—especially when the book is not outstandingly bad, but simply a kind of science fiction which does not happen to appeal to me. I *warned* everybody explicitly to query before submission; no one did. I'm drowning in a sea of 8½" x 11" paper that I have a moral obligation not to let out of my hands (I certainly would not want my unedited manuscripts in general circulation), and it's getting too warm out to run the stove and fireplace all day. Each takes up as much room as ten paperbacks, and although I specifically insisted that each come *in a box,* almost no one paid any attention, so I have stacks of pages spilling together. (The thing about rubber bands, Jack, they *break.*)

Also, it's frustrating to receive a terrific manuscript, in a box—the day *after* I mail off a column. That adds three fatal months before the launch window will open again and let me discuss it in print. I could solve this simply by reviewing monthly again, and you can cure headaches with a guillotine.

And so this is my last column for the

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foreseeable future. Wherefore it behooves me to spend the rest of it discussing books. When I subtract the ones I didn't want to read, the ones I didn't want to finish, the ones I don't feel like talking about, and the ones that Tom Easton has already informed me that he will be covering (he and Stan have asked me to avoid duplication), I am left with three books. See what I mean?

I think Ben Bova is one of the most moral, most socially responsible, and most criminally underrated writers in science fiction.

Nobody bothers to look up a pitcher's batting record. Everybody knows pitchers can't hit, that's why they became pitchers. Similarly, some people probably assume that a really first-rate editor must not be a very good writer. In SF there is less excuse than usual for this assumption, since a number of very good writers have accepted editorial jobs. But how many kept writing? John Campbell stopped writing fiction when he became an editor. Fred Pohl wrote little if anything while editing *Galaxy*, likewise H.L. Gold (although Pohl returned to fiction with a bang later). Damon Knight and Terry Carr produce little fiction nowadays, and Gardner Dozois's byline is too seldom seen. Don Wollheim and Lester del Rey seem to have hung up their typewriters for good, and Judith Merril is concentrating on nonfiction, the lecture/workshop trail, and consulting work, with no plans to come back to fiction.

Offhand I can think of three people in SF who are successfully challenging the shibboleth that editors don't write. Stan Schmidt ought to have some stories and a novel done by the time you read this; Bob Sheckley, fiction editor at *Omni*, has lately produced some stories and has a novel in progress. And Ben Bova, since he took over *Analog* and began one of the most brilliant careers in SF editing nine years ago, has produced several science fact books, a manual on selling SF, a survival guide for the suddenly single (in collaboration with Barbara Berson), a couple of superior juveniles, several story collections, and at least four major SF novels.

Voyagers is the latest and the biggest and, I think, the best of these latter, a work whose maturity and skill are as massive as its sheer physical bulk. (It is by far the fattest in this house, 791 pages.) It is one of those rare books which are accessible to the most ignorant non-reader-of-SF, without being so watered down as to insult the intelligence of the faithful.

I began this by describing Ben as moral and responsible. *Voyagers* may serve to demonstrate what I mean: Ben's insistence on tackling themes and topics of genuine importance and immediate relevance. His books tend to take place in near-future fictons which are more or less straight-line "If this goes on—" extrapolations of present-day reality, and to focus on crises whose roots are clearly discernible in the here and now. His books always leave you with the feeling, "Yes—that is the way it might happen." Again and again he returns to the question of racial survival vs. nuclear holocaust, and to the theme of personal heroism. In *Kinsman* and especially in the magnificent *Millennium*, Ben examined the continuing Cold War and demonstrated that if there is any hope for survival, it lies in individual acts of intelligent heroism, of personal ethical behavior at the gravest of personal expense. *Colony* studied the political and economic effects of space colonization, and again maintained that men and women of integrity and courage can make a difference.

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Now, in *Voyagers*, Ben returns to a Cold War setting, so near-future that Carl Sagan and Walter Cronkite are still alive and working in it, and adds one science fiction whammy: ETI. An American astronomer and ex-astronaut named Keith Stoner picks up a series of precisely timed radio pulses from Jupiter. Are they patterned? Are they *language?* When he tries to alert the world scientific community, he soon finds a government zipper on his mouth and invisible shackles on his feet. If the pulses *do* represent ExtraTerrestrial Intelligence, it is obviously possessed of superior technology—which must not be allowed to fall into the hands of them evil Roosians. Meanwhile, in Mockba, the Russians also have detected the signals, and a linguistics genius named Kirill Markov, whose wife is a KGB major, finds himself drafted to try and decipher the signals—in secret, of course, since the superior alien technology must not be allowed to fall into the hands of those evil Americans. . . .

Thus begins the most plausible and convincing account I have ever read of how the human race might really react to First Contact if it took place in-system in the next decade or two. And while the two giant bureaucracies grapple for position, individual heroes and heroines make personal choices based on a higher loyalty than nationalism or even romantic love, and bring about a startling resolution. Beneath it all lies the message that an intelligent species need not necessarily destroy itself, that the stars are within our grasp. And that individual intelligence and courage are the only things that will get us there. Refreshing to hear in these dark times.

The alien intelligence, by the way, turns out to satisfy my definition of "superior." Which seldom happens in stories like this.

This is the book to give to that friend of yours who thinks SF is escapist fantasy. He or she will have such a good time that they'll be done with the book before they realize that they've been cajoled into thinking. Ben is one of SF's very best ambassadors to the general public, and this is one of his very best efforts.

I do not generally talk much in these pages about heroic fantasy or sword and sorcery, on the theory that *Analog* readers tend not to be interested in thud and blunder. But this time I'm going to make an exception, for here, as far as I can determine, is something genuinely unique in the genre.

How many blacks are there in SF? Let's see: Delany is black . . . uh . . . Jesse Miller, old *Analog* alumnus and Campbell Award nominee . . . Octavia Butler, *very* talented newcomer . . . probably a couple others I haven't met but that's all I can think of. That's less than one percent of the total of working science fiction writers: depending on whose figures you accept, it may be less than a third of a percent. I don't know what the black/white ratio is in mainstream fiction, but I'm sure it can't be that low.

I do not know of any reliable demographics on how many black *readers* SF has. At conventions around North America I have observed a black fan ratio of approximately one percent—but fan statistics can be extrapolated to the general readership-at-large only with the employment of a fudge factor so large as to render the exercise pointless.

Well, then, how many SF books feature strong black *characters?* Again, I know of no serious study of the subject (I tell you, there's a thesis in this for someone), but on horseback I come up with Bova's Kinsman series, *Bug Jack*

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Barron, Starship Troopers, Stand on Zanzibar, Farnham's Freehold, The Moon Is A Harsh Mistress, Dhalgren, Golem 100, and my own first novel. I'm quite sure there are others, but I can't call them to mind at the moment. (If you know any I missed, let me know: I'm curious.)

Now: heroic fantasy is, in large part, reworkings of ancient myths. Judeo-Christian, Hindu, Egyptian, Norse, Greco-Roman, most of the world's great myth-systems have been plundered by fantasists. How much heroic fantasy has to do with *African* myths? Pretty large continent to ignore, eh? (Don't, please, tell me about Tarzan. Burroughs knew even less about Africa than he did about Mars.)

Charles R. Saunders is a black Canadian fantasy writer. He is quite large and solid and he looks most ferocious until he opens his mouth, wherefrom emerges a voice like Ted Sturgeon's: infinitely soft and gentle and merry. I first met him a few years ago when I journeyed to Ottawa to address the Ottawa Science Fiction Society. (If any knights from the Society for Creative Anachronism had been present, I could work up a pun about how I addressed them and they mailed themselves, but that'd cause a flap in which I might get stamped on, and some of you might in envy lope away.) Charlie was editor of the semiprozine *Stardock* at the time, and one of the small handful of selling Canadian SF writers, having published a few stories in assorted fantasy anthologies. He thanked me most warmly for having written a novel with a black hero and a black villain, extracted a story from me for his magazine, and laid upon me, most diffidently, a couple of his own stories about Imaro, the African spear-and-sorcery hero. I accepted them, frankly, out of politeness, for S&S usually bores me. But I started one on the plane home, and by the time I landed Imaro had, as Lord Buckley might have said, gassed me so bad I had to send out for the wig-tappers. A plausible hero, adventuring through a ficton built up over several thousand years of oral tradition, yet virginal in print-fiction terms . . . the stuff had power. I wrote to Charlie and told him that Imaro deserved at least one novel.

Imaro, Charlie's first novel, is as near as I can tell *not* paste-up of previously published short stories, but a true novel. It covers Imaro's origins, youth and early career, introducing you to a whole new flavor of heroic fantasy, created by a man who has obviously made a thorough study of African mythologies. He is still developing as a prose stylist, but he has a gift for characterization, a happy knack of eschewing the obvious, and a born storyteller's instincts. If like me you have enjoyed some heroic fantasy in the past, but have been waiting for something *new* to happen in the genre, this is it. I look forward to more of Imaro, and more from Charlie Saunders.

I guess it's too late now to review Vonda N. McIntyre's **Fireflood and Other Stories**: the paperback just arrived in the mail. But I can't resist telling you about it—maybe you could order it from the publisher? In addition to the stunning title story, it contains a truly wonderful novella called "Aztecs," which was a Hugo and Nebula finalist in 1977 and deserved to win. Quality-range of the remaining stories is from very good to superb. McIntyre has enough depth, subtlety, and pure creativity for three writers. Moreover, she can do serious and funny equally well; rare these days. I had thought that the computer-screwup story had been

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perfected by Gordy Dickson, but there's a story in here that improves on perfection.

This is not the kind of short story collection you want to read in a single sitting; some of the stories want you to sort of soak in them for a day or two. McIntyre is one of the best and strongest new voices in SF.

A final surprise present for some of you. Robert Heinlein has given me permission to blow his cover here, and I can't resist using it for a closer.

This is for anyone who has read "*The Number of the Beast*—" and failed to identify The Beast and understand what became of him. If you are still wondering who it is that sows the fictons with discord and strife, but fails to do their characters any lasting harm, and escapes unscathed at the end . . . try unscrambling each of the aliases he uses.

Here, I'll do a few for you. "Neil O'Heret Brain." Did the humor of a professor named N. O'H. Brain distract you from the fact that his name is an anagram of "Robert A. Heinlein"? How about ranger Bennie Hibol/Bob Heinlein? Did you read "The Villains Nine Rig Ruin" as "Lt. Virginia Heinlein USNR"? Every name The Beast uses is an anagram for Robert or Virginia or for one of his pen names. (L. Ron O'Leemy, for example, is Lyle Monroe.)

And so is revealed the Name of The Beast, as if the hint on pages 481-2 weren't enough. What a *lovely* book! Its last lines are:

" ' . . . We've seen the last of *it*.'

"The voder answered: 'Friend Zebadiah . . . are you *sure?*' "

Zebadiah John Carter may indeed have been sure—but it turns out he was wrong. The Beast will be back. As I write this, The Beast is even now teaching himself to use his new word-processor . . . by cutting the completed first draft of his new novel.

And now, with a vast sigh of relief, I yield the floor to my esteemed colleague Thomas Easton. Hang on a minute, Tom—here come the last four cars of that express-train. . . .

So long, people. You've been great. See you in the fiction pages . . .■

IN TIMES TO COME

Our December lead story is the debut of Thomas R. Dulski, a promising new writer with a knack I'm always watching for: combining good hard science with good entertaining storytelling. The science at the heart of "The Trelph Is A Solitary Creature" is an intriguing interaction of alien ecology, "anthropology," and physics—some of it probably surprising, but on close inspection more plausible than you might at first think. The humans establishing their industries on the world of the Wyntaraag *were* exercising reasonable caution, you see, and it was quite obvious to them that their disturbance of the status quo was much too trivial to warrant the natives' strong reactions.

But then, most people who've worked much with technology have observed at one time or another that a major problem can sometimes be caused by something "obviously" too small and remote to matter....

John Gribbin returns with a fact article entitled "Base Eight Arithmetic, Meteors and Man"—a peculiar combination of topics to lump together, you may say, but they do fit, as you'll see when you read it. And by an odd coincidence, the article ties in rather neatly with the conclusion of David Bischoff and Thomas F. Monteleone's *Dragonstar,* also in next month's issue.

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We all know that "life" insurance really isn't. But suppose it were....

Eric Vinicoff

THE GUILT GAME

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Scott Van Hise woke up bleary-eyed, fuzzy-tongued, and feeling strange. Damn Mel anyway. How had he let himself be talked into this weirdness?

Half a day shot every month, for nothing. It was a pain in the posterior, not to mention potentially embarrassing. What if someone were to bend the law and scan his tapes? He knew several "fellow members of the legal fraternity" who were built that low.

"Mister Van Hise? Scott?"

He forced his eyes to focus. His courtroom-honed nerves began to tingle. He wasn't in the cyrebro-scan lab anymore; he was in a private hospital room. And the person hunched over him wasn't the well-assembled female techno who had put him under. It was Doctor Jas Goodrow, sartorically perfect as usual in his Saville Row three-piece. Scott had never seen the psychologist outside of the orientation classes before. His tingling quantum-jumped. "Where's Sheila? What's going on?"

Doctor Goodrow smiled with professional reassurance, his teeth prominently white against the coal-black skin. "Take it easy, Scott."

"I'll be able to take it easy when you answer my questions."

"I'm going to do exactly that. But first, how do you feel?"

Come to think of it, he felt *damned* strange. He felt like he was wearing someone else's body over his own psyche. He looked down, but his white-gowned physique lying on the bed appeared normal. "What went wrong?" he asked with a forced calmness. "Did Sheila cross some wires or something?"

"Nothing like that, Scott. Please try to relax. The doctors tell me the disassociation will pass after you're up and about."

Scott silently counted to five as anger lifted him above worry. "Quit talking around it, Doctor. Please."

The psychologist sighed. "Okay. You know the reason for your monthly memory record updates, of course."

"Sure. To line your pockets. So?"

"So brace yourself for some heavy news."

"How heavy, damn it?"

"Well," Doctor Goodrow was absently slapping a fist into a palm, "about as heavy as it can get. You had an accident."

"While under Gotham Life's care! I hope your corporate assets can handle a million-plus PI suit—"

"You died, man!"

Scott began to laugh, high-pitched and hard.

"What's so funny?"

"Excuse me, Doctor, but I think I'm in your bed. What happened to the padded walls? One of us is crazy, and I'm sure hoping it's you."

Doctor Goodrow didn't react. "It's no joke. I'm sorry, Scott. You died over two weeks ago in a car crash on the way to work. A tire blew out on the expressway; you lost control. We kept it out of the media, of course, but here's a police photo." He held an eight-by-ten color glossy so Scott could see it.

Too bad the special policy experiment was under a secrecy lid. In death he might finally have made the front page of the *Times*. Not very flattering, though, him welded into all that steel and chrome. PROMINENT ATTORNEY DIES. A third of a column, no less.

"Stop it, Scott!" Doctor Goodrow

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snapped. Scott realized he had been laughing again.

He managed to stop, then said, "It wouldn't be hard for someone to fake that photo. Prove it to me."

"What? That you died?"

"Damned straight!"

"Okay. Come with me. I was hoping this wouldn't be necessary. Be careful; think about each step. Your muscle tone and reflexes will need a lot of work."

He helped Scott out of bed. Scott's limbs moved reluctantly. But the jury was still out on Doctor Goodrow's claim. This was one case he planned to fight to the last appeal, not concede a point.

The room next door had been converted into a temporary morgue. "All for your benefit," Doctor Goodrow explained. "Since you're the first, we're sparing no expense."

"Imagine my glee."

An orderly rolled out the tray. Scott stared at the face of the torn meat thus revealed.

The room started spinning and slanting every which way. Doctor Goodrow grabbed him and guided him back to his room and bed.

"I . . . I . . ." Scott couldn't get the words out. "I . . . never really thought . . ."

"Your special policy went into effect." Doctor Goodrow's voice was hoarse. "Do you understand what I'm saying? Look at your stomach."

Scott looked down. Black hands parted his gown.

Pink-white skin, smooth and flawless. No appendectomy scar signifying how he had almost died at the age of eleven.

"It happened, Scott. You're a clone."

That was when the universe mercifully snuffed him out.

Helen Van Hise pushed Jeremy through the revolving door of the Gotham Life Building and crossed the busy lobby to the elevators, as she had every other Tuesday for the past year and a half. But this wasn't another orientation session. For one thing, it was a Thursday morning. And none of the other people waiting for the next car up were fellow special-policy holders. And Scott . . . Scott . . .

They got off at the twenty-second floor instead of the ninth. No reason, Mel had said, to use the big meeting room for just the five of them. His office would be more comfortable. Jeremy was being silent and balky, as he had been since his tantrum at breakfast. She wished she knew how to make it easier for him. Or herself, for that matter.

The secretary led them into Mel's office immediately. It was everything one would expect the sanctum of the president of a major company to be, if not more. But she wasn't in the mood to be impressed.

Mel Guilder rose, came around his desk, and guided them to a sofa. Doctor Goodrow also got up out of his chair and said good morning. She knew the psychologist well from the orientation sessions. Mel she had only met twice before: when Scott had taken out the special policy, and the day Scott had died. Mel was in his sixties, trim and prosperous looking. Even through tiredness and worry he exuded the charm of a successful career insurance man. The tiredness and worry were easily under-

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stood; the special policy program was his creation.

"Good morning, Mrs. Van Hise," he said. His voice was very pleasant and soothing, but it did nothing to untie the knot in her heart. "Hi, Jeremy."

Jeremy stared sullenly. Helen looked around. They were definitely alone, thank God. Her palms were damp. Where was he? She felt like she was speeding down an inescapable greased slide, with horror at the bottom. A year and a half of preparation hadn't really prepared her. Or Jeremy.

"I want a funeral for him," she said firmly. "I don't want him buried in secret, without mourners, like some kind of cri . . . criminal!"

"Of course not, of course not," Mel replied. "There will be a funeral. But you'll recall from the orientation sessions why it will have to be postponed for a month or so, and the mourners limited to the three of you."

"The emotional loading of a funeral now would be deadly to your adjustment," Doctor Goodrow cut in. "It was bad enough letting you view the remains. But I understand your need for certainty." His eyes kept glancing at Jeremy, whose attitude plainly had him worried.

Helen recalled how Doctor Goodrow had explained the problem to her at an orientation session. Jeremy was twelve. A couple of years younger, and his self-absorption would have made the situation less traumatic, since he would have realized it less. A couple of years older, and his increased socialization would have made the abstract values involved easier for him to accept.

Mel touched a button on his desktop com. "Doctor Goodrow and I feel that delaying this any further would just increase tensions. We're going to treat it as the natural occurrence we hope it will someday be." He walked to the door, and opened it. "Good morning, Scott. Please come in."

Scott took one step into the office. He looked pale but composed. "Hi, Mel," he said tonelessly.

Mel shook his hand, radiating unfeigned warmth. "Good to see you awake. I popped in on you a few times when you were . . . ah . . ."

"Growing," Doctor Goodrow inserted. "Scott has to get used to discussing himself."

Scott flinched, but nodded. "I can take it."

Then he saw Helen and Jeremy. Jeremy was glaring at him like a wary animal. Helen didn't know what she looked like, or how she felt. She stood up. Her knees unlocked, and she swayed. Doctor Goodrow moved quickly to help her, but Scott was quicker. He grabbed her by her elbows and held her up. "Dear? What is it?"

She stared up into his face, seen through a red haze. "God. What have we done?"

"Huh?"

She pulled away and sank shakily into a chair. Scott would have gone to her, but Doctor Goodrow steered him firmly to another chair across the office.

"We knew there would be an initial shock," Mel said, returning to his desk. "Now that it's behind us, we can start fitting the pieces of the future together."

"God," Helen muttered again. "It was never . . . real. More like a joke. Our stab at immortality."

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"You know it wasn't like that!" Scott flared. "I hated to think about it myself, but neither of us wanted to leave the other and Jeremy to cope alone if . . ."

"The problem of acceptance is natural," Doctor Goodrow eased into the silence. "Scott intellectually knows that he died. He knows he's a clone, a force-grown genetic duplicate."

"But I don't *feel* it." Scott was grim, staring anxiously at Helen and Jeremy. "I feel like me . . . like Scott Van Hise, that is. Damn it!"

"That's exactly who you are, in essence. Except for losing the thirteen days of memory between your last update and the accident."

"A small price to pay for being reborn," Mel said. "You wouldn't be in this program if you had any philosophical or religious problems with the concept. You will be . . . no, you *are* Scott Van Hise, Helen's husband, Jeremy's father. *De facto* and *de jure*."

"But . . . how do I accept it?" Helen almost whispered. "How does Jeremy? The man we loved died in a car crash."

Scott winced. Mel frowned and said, "You all knew this day might come when you took out the policy, and we've tried to cushion the blow as best we could with the orientation sessions. But this situation is as novel as it is difficult. It must even seem bizarre. Many new ideas have seemed bizarre until their beneficial values won their acceptance. Now you're the first pioneers, so you have to break the cultural ice."

"I'll be available to help you every step of the way," Doctor Goodrow said. "I've had a good chance to size you up during the orientation, and I'm sure you can handle it."

Scott looked at Helen and Jeremy. "I don't feel like a clone or anything. I'm me. I can tell you my favorite breakfast, my most hated government official, why I love both of you. I went to sleep. I woke up. I'm here."

"I wish it were that easy for us." Helen shuddered. "I remember how stupidly *sure* I was in the sessions that I could deal with it. The confidence of not really believing it would happen, I guess. You look like him. Talk like him . . ."

"Let it be that easy, dear. Please?"

Longing and need surged through her. But she remembered the corpse under harsh morgue lights. She said, "How can I? I have to think of Jeremy."

"How do you feel about all this, Jeremy?" Doctor Goodrow asked. Jeremy kept glaring, even more animal-wary, a rabbit ready to bolt from predators.

"Jeremy needs a father and a mother," Mel said softly. "That was the main reason both of you expressed for taking out the policy, remember?"

Helen tried to shake the jumbled thoughts and feelings in her head into some sort of order. "I just . . . don't know."

Doctor Goodrow eyed Scott, Helen, and Jeremy critically. "I think you three will have to take the next step yourselves."

"What?" two voices demanded.

"Go home. Don't try to find all your answers at once. Hang loose, live your lives a day at a time. See what kind of temporary adjustments you can work out."

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"Why temporary?" Scott asked.

"Permanent adjustments take time. Don't press; don't worry if it doesn't seem to be coming together."

Mel rose and went to the door. The time had come to propel them into the fray. "Don't forget our meeting tomorrow; same time, same place."

Scott walked over to Helen and Jeremy. "Let's get out of here. I've been cooped up in a hospital room much too long; I need some normal, unhealthy food. Jer, you look like you've had all of this you want and then some. Come on."

Helen looked wildly at Mel and Doctor Goodrow for an instant, then pulled herself together. *You just keep going.* That was how she had always gotten through the bad times. By out-enduring them. She mentally squared her shoulders. "I'm ready."

She stood up, pulling Jeremy up too. There was a round of brittle goodbyes. Jeremy shrank from Scott; he walked on the other side of his mother as they left.

Mel and Doctor Goodrow looked at each other for long moments, frowning. Then a second door, marked PRIVATE, opened. A middle-aged woman stepped out.

"I think it stinks," she snapped.

"You saw and heard everything clearly, I trust?" Mel asked smoothly.

"Of course. Your security system works fine. But what I saw and heard only confirms my doubts."

"It's too early to say that for sure," Doctor Goodrow objected. "I've seen less promising situations work out. Watch and see."

The woman wasn't buying it. "The Secretary wants your program to succeed. He sees a potential social benefit. Expensive government facilities have been put at your disposal. You've been granted special-case exemptions to several laws and regulations. But his support of such a controversial program can extend only so far. If I put in a negative report—"

"Is that what you intend?" Mel asked. For the first time something showed through his control, something of what had driven him to gamble his successful career on a visionary scheme. If this first test blew up in his face, his narrow board-of-directors majority would melt like an ice cube in Hades. So would *his dream.*

"I haven't decided yet."

"Do you know what we insurance people call our profession?" he asked rhetorically. "The guilt game. We bend our persuasive skills to making breadwinners feel guilty if they haven't insured their families to the hilt. We convince them to equate love with money. Then, when we hook them, we defraud them. We promise the beneficiaries security, and comfort for the grief of their loss. But all we can deliver is money. Money can't love a spouse. Money can't raise a child properly. Now science has given us the opportunity to actually replace what the beneficiaries have lost. We've solved the technical problems. If we can solve the moral and psychological ones, we can do a lot more good than our monthly checks ever have."

The woman looked away. "I'll withhold my decision at least until after tomorrow's meeting."

* * *

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Scott, Helen and Jeremy stepped out into the crisp, bleak autumn morning. The sidewalks were jammed with coat-wearing figures, the streets with vehicles. Sudden noise assaulted them.

The scrawny trees along Fifth Avenue were almost denuded. Vari-colored leaves were a carpet for them as they buttoned their coats and pulled on gloves. Scott exhaled and watched the white plume disperse.

"Subway or walk?" he asked. He knew she wouldn't have used her car for such a short and traffic-hassling trip.

She stared at her feet. "Maybe going straight home is a mistake. Maybe we should stop for a bite of something."

He lifted her chin until they were eye to eye. "I'm sure there's food in the fridge. I want to go home."

She stepped back from his touch. "Let's walk."

"You're awfully quiet, Jer," he said to his son. "You should be happy at getting a day off from school. Maybe you'd like to go to Central Park this afternoon, to the zoo. How about it?"

Jeremy shook his head.

They "strolled"—pushed through the crowds—in silence. Clouds hung over the world. Something was brewing up there, probably slushy snow unless the temperature rose.

As they crossed 72nd Street, a car ran the yellow and almost hit Jeremy. Scott yelled, "What's your damned hurry—there's plenty of room by the Fire!"

Helen giggled. "You know how ridiculous that always sounds—" She stopped abruptly, paling.

For awhile they went on without words. Helen glanced furtively at him several times. His expression was that of a man lost and alone. The still peace of the trees as they walked through Central Park seemed incongruous. They crossed Central Park West and passed under the shadows of towering buildings, again battling masses of humanity.

"People-pie," Scott muttered. "Why don't a few million of them move to California and leave some room for the rest of us to breathe?"

"The same reason we don't. There are so many good things here. You have to pay the price for them."

"For now, maybe. But not forever."

"Oh, come on," she chided. "You grumble, but where else could you be happy?"

It was a fragile echo of former debates, and both of them felt awkward pain. "On a beach in Tahiti. Sipping rum with Gauguin."

She smiled thinly. "With his ghost, you mean. And it would bore you to tears. No opera, no symphony, no theater, no museums, no libraries, no great restaurants."

"No night court or early morning plea copping sessions."

"You love the wars; don't try to con me. Otherwise you'd keep regular nine-to-five weeks like most of your colleagues."

The Dorchester Towers was a mammoth concrete and glass structure complete with doorman and other accoutrements of wealth. They entered and rode the elevator up to the ninth floor.

Outside the door marked *906* Helen paused to look at Scott. Then she hesitantly touched her right hand to the

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ident-plate, and the door opened. They went in.

The soft beige and white of the apartment welcomed them, setting off the bright prints in the long hall opening on the living room. Scott strode around the living room, drawing reassurance from the trophies of his life. Law books in the teak standing case—*pro forma*, since he did his real research on the computer terminal in the den. Several law reviews with his articles in them. Paintings carefully selected by Helen and him for beauty as well as investment value.

Jeremy started for his room, but Scott grabbed a shoulder. "Whoa!"

"I want to watch TV."

"So you're finally speaking to me. Good. While you're in a communicating mood, I think we had better talk this out. You understand what has happened; you sat through all those sessions too. It's me, Jer. Your father."

Jeremy tore free of the gentle grip, and retreated toward his mother. "The hell you are! You're not him! You're a damned clone!"

Scott took several quick breaths. "Yes, I'm a clone. But you have to understand why—"

"You're a fake! You stole his body and memories!"

"Hush!" Helen said sharply. "Don't talk like that to your . . . to any guest in our home! You hear me?"

Jeremy spun to face her, trembling. "You're on his side!"

She went white. She reached out for him, but he backed away.

"Damn it, Jer, listen to me!" Scott almost yelled. "I know it's a big shock. But you'll get over—"

"Go away!" Jeremy screamed. He ran to his room, and slammed the door behind him.

Seconds later faint television voices mocked the sudden silence in the living room.

Scott walked slowly to the teak bookcase and leaned on it. "I sure as hell blew that, didn't I?"

Helen said nothing.

"Great attorney," he muttered. "Deep, subtle mind. Can't even communicate with a child—my own son yet."

For long moments they just stood in the stickiness. Then she went over to him. "It isn't going to work."

He turned. "Huh?"

"Your staying here. It just won't work."

His expression twisted. "The hell it won't. This is my home too. I paid for it. Mel says all of my legal rights carry over—though how he put that particular scam over is beyond me."

"I'm not talking about legal rights. Look at what this is doing to Jeremy. We all . . . need time. Time to figure out what's happening here."

He was looking at her sourly.

"Please," she begged. "Stay at your club. Just for a few days."

He moved closer to her. He was breathing fast, but otherwise remained under rigid control. "Why my club? Why not Siberia? Or the center of the sun?"

"That's not the way I meant it. Just . . . some time . . ."

"For me to *adjust*, right!" He took her by the shoulders and shook her. "Adjust myself to not being who I know

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I am! Adjust myself right out of your lives! No way!"

They held that tableau as seconds dragged by.

Then he pulled her to him and kissed her; a brutal, desperate kiss.

She yielded passively, entranced, allowing dream-memories to carry her, not questioning.

Not . . .

"No!" She tore free. "Leave me alone!"

"Damn it, quit playing games! You want me—I could feel it! You need me as much as I need you!"

She shook her head.

"Okay, to hell with it!" He stalked into their bedroom. She followed at a distance.

He began throwing clothes into a suitcase. "You don't mind if I take some of *his* things, do you! He won't be needing them!"

She was a statue of unmeltable ice.

He went to the front door, then paused. "I'll see you at Mel's office tomorrow. Maybe he and Doctor Goodrow can get your head straight."

"Scott?"

"What?"

"I'm sorry."

"Oh, hell!" The door slammed behind him.

Mel was behind his desk again, and Doctor Goodrow perched on the edge of a chair next to him. Thus there wasn't any buffer between Scott and Helen, who made up the other two corners of the inwardly directed square. Jeremy was at school; after today the twice-weekly sessions with Doctor Goodrow were scheduled for evenings so he could join in.

"Did you drop by your firm this morning?" Doctor Goodrow asked.

Scott nodded. "How did it go?" the psychologist continued.

"Weirdly. How did you expect it to go?"

"Did you have any difficulty with your cover story?" Mel interrupted.

"No. Everyone said I looked remarkably well for a man just out of intensive care. Some didn't understand why visitors were limited to the immediate family, but I just smiled and kept repeating your coma fantasy. They seemed to accept it, even the part about my 'amnesia concerning recent events'. If there's one thing I've learned to do well in my profession, it's lying plausibly."

"How long will we have to keep lying to everyone?" Helen asked unhappily.

Mel sighed. "I can only repeat what we've been telling you all along; for the foreseeable future. Maybe forever. At best, it'll be some years before we can educate the public to a reasonable level of acceptance. Otherwise you'd come in for an unpleasant amount of notoriety, to say the least. None of us want that."

"So where do we go from here?" she asked Doctor Goodrow.

"To the end in the end, natch. Let's take it day by day."

Plainly unconvinced, Scott turned to Helen. "I have to see Jer again, make him understand."

"I brought up the subject at breakfast as carefully as I could. He threw another tantrum."

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Doctor Goodrow shook his head. "Sounds like your family reunion isn't going too smoothly."

Scott's and Helen's expressions said all that needed saying.

"A bad sign," Doctor Goodrow went on. "But not particularly surprising or conclusive. It just means more work, more time."

"Damn time!" Scott was on his feet, livid. "I'm *me!* And sick of being treated like something that crawled out of a septic tank!"

"Calm down," Mel said. "It's tough, but everyone has to put some courage into the pot. You too."

"Don't lecture me from your Olympian detachment! This whole sick exercise was your idea!" Then, to Helen; "You lied, you and Jer! When we signed up for the policy, through all those sessions! We can make the adjustment if we have to! Shit!"

She paled and choked on a reply. Scott headed for the door.

"Where are you going?" Doctor Goodrow demanded.

"Maybe a bar! Maybe Tahiti! What's it to you? At least I have some money that knows me!"

He left.

Mel reached for his intercom, his face a grim mask. "What are you doing?" the psychologist asked him.

"Calling the lobby guards. They can bring him back."

"Why?"

"Huh? He's distraught, man. He might—"

"He's working out his adjustment. Leave him alone."

"You're crazy."

"You're paying big bucks for my expertise. You want it or not?"

Mel's hand slowly retreated from the intercom.

"Neither of us can help him now," Doctor Goodrow went on. "We can only hurt him more by pounding at his identity problem."

Abruptly Helen rose and went to the door. "I'll go talk to him."

"And say what?" Doctor Goodrow asked.

"I don't know."

"That just might be the best approach. Good luck."

"You might not be able to find him," Mel pointed out.

She thought about it, then smiled slightly. "I think I know where to look."

Walk sixteen blocks south from the Gotham Life building on Fifth Avenue. Then look up. You'll see a vast Neoclassical edifice, a reminder of past glories and the translation of epic personal wealth into civic symbols. The Metropolitan Museum of Art.

In the side court was the Fountain Restaurant. A wide fan of multi-colored water sprayed mist in the gloomy afternoon. Tables and benches surrounded it.

Helen entered the court and looked around.

Scott was the sole occupant of a bench on the far side.

She went over and sat down beside him.

He turned. "Why?"

"I guess I feel responsible. Partly, at least. I went along with you—with my husband in taking out the policy."

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"Forget it," he muttered. "I know how damned persuasive I can be. I meant well, but the whole thing just doesn't seem to make sense now. I could almost convince myself we'd all be better off if I had stayed dead, except that it feels so good to be pushing air in and out. Okay?"

"Not okay. It's too late to be that simple."

"Why? You and Jer are right where you would have been if I'd never been . . . The joint accounts, the stocks and the community property are all yours. My personal effects and the income from my practice will do me."

She brushed that aside. "Money isn't the problem, and you know it."

"Money is the only issue left. I'm opting out of the rest of it. I can tell where I'm not wanted. Or needed."

She didn't know how to respond. Something hard was forming in her abdomen. She reached out to touch his hand. "Can you just climb out of your life like that? Walk away?"

"I don't seem to have any choice. I'm not me, remember?"

She looked more closely at him, and saw dampness on his cheeks. She had never seen her husband cry.

"I guess I understand now," he said softly.

"Understand what?"

"Where Mel and I—where all of us went wrong."

She waited.

"The clone isn't the person. At least I'm not."

"How so?"

"Oh, I might have taken up where the original Scott Van Hise left off. But experience has made that impossible. The people closest to me know what I am—including me. They react differently to me—again including me. So I change."

She mulled it over momentarily, then said, "You're right, of course."

"So I have to start a new life. As do you and Jer."

"Yes—and no."

"Huh?"

She took a deep breath, and tried to calm down. It had come to her so suddenly, from an unexplainable part of her psyche. But she knew it was true. She felt overwhelmingly that it was true.

"You aren't my husband, or Jeremy's father. He's dead. We have to accept that, cut through it to see the rest of the truth. Because there is more. You're you—like him, yet different because of what you just said."

"And?"

"And I'm not afraid of you anymore. I want to get to know you better."

He looked into her cool green eyes, and saw it too. He smiled as some of the misery washed out of him. "How about a bit of lunch?"

The fluttering in her stomach surprised her greatly. She hadn't felt that since their courting days. "Okay. Then maybe we can drop by your room at the club and, um, read some writs."

They approached the door of their apartment with fading euphoria, the drained sensation of reentry into turmoil. All the long afternoon they had spent at the club. Only the nearing of suppertime and thoughts of Jeremy had forced a temporary ending to what they had found.

He gave her a quick kiss as she

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touched the ident-plate. "Time to cross the Rubicon, dear. God, I hope we can get through to him."

She pursed her lips. "We'll find a way." She let go of his hand—they were very aware of each other tactilely—and they went in.

"Jeremy, come out here, please!" she shouted at the closed bedroom door.

Silence. The apartment felt empty.

"He should be home by now," she said as she opened the door.

Jeremy's bedroom showed signs of a rapid and disorderly packing job. The note was on the bed. It read, "I won't live with that fake. I'm running away."

"Jesus!" Scott exploded.

She sagged onto a corner of the bed. "What can we do? Call the police?"

He was thinking as quickly and effectively as he could. "No good. They won't put out a missing-person report for twenty-four hours. And even then they have too much keeping them busy to do much searching."

"Then what! Scott, he hasn't any money! And it's almost night! He could get sick, hurt, picked up by some pimp—"

"Hold on! What we need is someone who can get the police moving right now. I'll call Mel. He wants to save his damned project; he'll get things moving fast, since if anything bad happens to Jer the publicity would be hard to avoid. I'll call him on the den phone. Use the one in the kitchen—start calling his friends' parents, Aunt Anne, anyone he might go to for help."

They bolted for the doorway, acting with a minimum of planning, relying instinctively on their knowledge of each other.

* * *

In Central Park there was a zoo. Not a large one like the Bronx Zoo, and not nearly as well known. But from Jeremy's twelve-year-old perspective it was a place of wonder, his favorite place. He loved it, owed his happiest memories to it, and now that he was in desperate need of security he had returned there almost without thought.

The time was crawling past 9 PM. He had successfully hidden in shrubbery to avoid being forced to leave at closing time. The cold cut through his warmest coat, but fortunately it wasn't raining or snowing.

He sniffled, huddling next to his suitcase on a bench near the lions. His vague notion of spending the night in the zoo and figuring out where to go in the morning was becoming a terrifying reality. The animals' food he had thought to pilfer had turned out to be either inedible or out of reach. The concession booths were locked up. He was so cold! But he ground the images of his warm home under his sneaker heel each time they tempted him. He would make everyone sorry for what they had done to Dad. And him.

If he could only find some food, and a place to get out of the cold so he could sleep.

Suddenly a big black hand grabbed his shoulder. "Whatinhell you doin' here this time o'night?" a rough voice demanded.

He tried to tear free to run, but the grip was unbreakable.

"Lemme go!" he screeched.

"Cool down, kid." The black man was huge, but old, stooped and white-haired. His face was a mass of wrinkles

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partly hidden by thick glasses. He wore the gray coat and pants of a zoo employee.

Jeremy's terror became immediate and stark. "Lemme go! I'm not doing anything!"

"You're trespassin'. I'm gonna take you t' the cops. They'll send you home. As if I don' got enough t' do feedin' these beasts. C'mon!"

"No! I don't want to go home!"

The old man scratched his head. "Too bad. That ain't my problem. You are. Gettin' you out o' here, that is. Now hoist it."

"No!" Jeremy set his heels to stay where he was.

The old man gave him a long, fierce look. "Why not, kid? What could be worse'n spendin' the night on a bench? You in trouble with the law?"

"No! It's . . . My dad died! Mom and this other man . . . they're pretending he's my dad. I hate them! I won't go home!"

"Oh. I think I got it. So you're runnin' away?"

"Yes!"

"Think that'd please your dad?"

Jeremy froze.

"How about it, kid? You can be sure he's watchin' you real close from heaven. Think he'd want you runnin' away, hurtin' your mom an' not bein' there t' help when she needs you?"

Jeremy felt sick. He couldn't speak.

The black face loomed even larger over him, casting a shadow of fear. The grip was twisting his shoulder painfully. He wanted more than anything to run away, but he couldn't. "Leave me alone!"

"Wouldn't your dad want your mom an' you t' have a man t' take care o' you? Wouldn't he? An' what're you doin'? Runnin'. Runnin' like a gutless wonder, goin' against what your dad'd want. What's the matter with you? You must be a real rotten kid, disobeyin' your dad's wishes. You must not've loved your dad at all. Fact is, I bet you hated him, didn't you?"

"Shut up! I loved Dad! Shut up!"

He tore again at the old man's grip, and this time escaped. For a moment his mind blanked. Where could he go, where could he hide and be safe? The night was pitch except for the lighted cages and the widely spaced pole lamps. Then he saw the figure of a man appear in the cone of light of the nearest lamp.

Dad!

Unthinking, he ran to his father and sought refuge in his arms, sobbing.

"Do you want to go home, Jer?" Scott asked. He had no idea how Mel had known Jeremy would be here, or what had terrified him. He looked at the bench where Jeremy's suitcase sat, but there wasn't anyone or anything menacing in the area. The hell with riddles. They could wait until Jeremy was safely back home.

"Let's get your baggage and leave," he said as comfortingly as he could. Jeremy couldn't talk, but he nodded. He hugged close to Scott as they walked to the bench.

When they had disappeared into the gloom on their way to the exit, two men detached from the night and stepped over to the bench. The "old zookeeper" was wiping makeup from his face and hair, uncovering a much younger black man. "Well, Jas, did you hear it all?"

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The second man was Doctor Goodrow, blowing into his hands to keep them warm. "Yeah. Thanks one hell of a lot, Rod. I always said you were a better actor than a psychologist."

"I'll take that as a compliment." But Rod was wearing a sour expression. "This was as dirty a thing as I've ever done; scamming a child. I sure hope you know what you're doing. Beyond profile-reading that he would come here."

"Believe me, Rod, the pressure job wasn't from choice. But I had to generate some kind of breakthrough between him and his father, and quickly. At his age he's too self-centered to be reached by anything more subtle than a direct blow at one of his primal needs. Was I wrong?"

Rod shook his head, but his expression didn't change. "This doesn't really resolve the trauma, you know. Just suppresses it temporarily."

"That's all I hoped for. It buys me time to create a healthier adjustment through our counseling sessions."

"You really push it to the edge." Rod muttered.

"Only when I have to."

Mel, Doctor Goodrow, and the middle-aged woman were seated in Mel's office, watching the disks on the VTR slow down.

The woman rose from her chair. "That's it. I'm sorry, Mister Guilder."

Mel nodded wearily.

"My report will have nothing but praise for the sincerity of your efforts, but it just didn't pan out. What you hoped to accomplish was too extreme."

"What makes you think we failed, lady?" Doctor Goodrow asked.

The other two turned to face him.

"True," the lady said mincingly, "the family is together. But none of them has done what you wanted, namely accept the clone as the original Scott Van Hise."

"Didn't they? Look at the actions, not the words. They're living together, supporting each other, giving each other love and security. That's what we wanted. As for the details of their adjustment, they're all we could reasonably hope for this first time. My report will go in with yours. It'll say the results are good enough to keep the project going."

Mel grabbed the lifebuoy gratefully. "HEW has to give us time. The major challenge is winning acceptance of an admittedly bizarre new idea. I could reel off a long list of new ideas that were once absolutely bizarre and unacceptable, but are now commonly accepted because they're beneficial. This can be one more. But we need time to break down the psychological barriers."

Her silence was an agony for him to endure. His hope was that she would see the evidence as too ambiguous for her to recommend cancellation to a superior who favored the project.

Finally she said, though her face clearly expressed personal disagreement, "I'll inform Secretary Rabkin of your conditional success. He'll be glad to hear there's some justification for optimism. I have no doubt the project will be allowed to continue through the remainder of the trial period."

Mel and Doctor Goodrow smiled at each other. ■

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biolog

By Jay Kay Klein

David Bischoff

The other half of *Dragonstar*'s "two-headed author" is David Bischoff. Like his collaborator (profiled in last month's column), Dave makes his first appearance in *Analog* with this novel. Continuing the similarity, he has a non-science background, which is not a rarity but probably a minority among those writing for this magazine.

On the other hand, Dave has been a science fiction addict since a teenager. He says, "I thought that the highest calling in life was as an SF writer." After completing a degree in radio, TV, and film at the University of Maryland, he started to sell short stories. Now he's a full-time writer living in Arlington, Va., following five years as a TV production assistant and television stage manager at NBC in Washington. He has written mystery, fantasy, historical, horror, and nonfiction works.

Science fiction is still Dave's favorite, and he continues to be a fan, attending as many conventions as he can find time for. Enthusiasm for the field also extends to the remaining hours of the day. He was an elected official of the Science Fiction Writers of America, serving as secretary for two years and vice-president for one. And he has taught college-level science fiction writing courses.

Dave gives some insight into writing. "Although I've written a number of novels on my own, I quite enjoy collaboration. Writing is a lonely business. To share the creation of a novel with someone else is often an educating experience, and *always* at least interesting. Each collaboration is a different experience." Two heads got together for this issue's serial when he told Tom Monteleone about an idea for a juvenile modeled after Doyle's *Lost World*. "Juvenile, schuvenile!" Tom exclaimed inimitably. After that came the research for a much more ambitious story, helped by Dr. Charles Sheffield, and the writing. Dave feels the result was like nothing he'd done before and has expanded his personal universe. He says that as long as he can continue to write books that entertain himself, he will stay in the writing business.■

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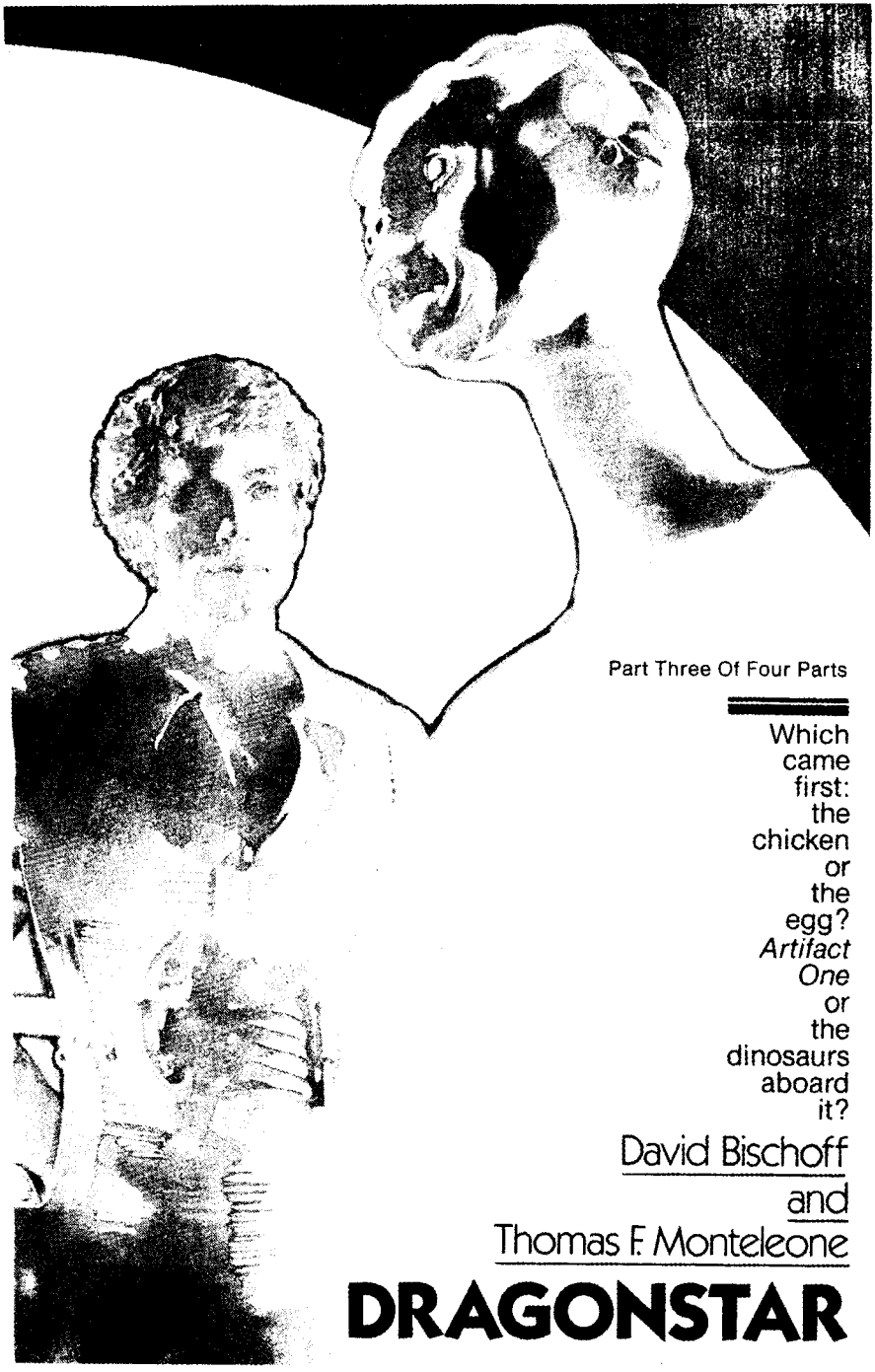

Part Three Of Four Parts

Which came first: the chicken or the egg? *Artifact One* or the dinosaurs aboard it?

David Bischoff

and

Thomas F. Monteleone

DRAGONSTAR

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SYNOPSIS

The year is 2027 A.D. *On Copernicus Base—the IASA Lunar Colony—***Colonel Phineas Kemp,** *base commander and chief of deep space operations for the IASA, is awakened from sleep and called to the lunar observatory by* **Professor Andre Labaté.** *It is an urgent, top-secret meeting.*

A strange object has been detected passing through the field of view of the observatory's photometer array. From earliest data, the object is travelling in a cometary orbit down the gravity well towards the sun. Professor Labaté is baffled by the object as he tells Kemp that it is presently passing within the orbit of Jupiter.

Because of the currently delicate political situation on both the earth and the moon, Kemp immediately puts a top-secret classification on this information. He considers sending an IASA ship into orbit-intersect course with the object for close-up analysis, realizing that the closest ship for the mission must be on of the IASA mining vessels currently working the asteroid belt.

The political situation is this: the Russians have allied themselves with the Western nations in space operations—the result being the IASA. The Chinese also have a lunar colony, and an uneasy truce with the rest of the world. The real center of global tension lies with the power structure of the TWC, the Third World Confederation—an alliance of Arabic and African nations which became an extremely powerful force internationally because of their death-grip upon the planet's petroleum resources. Their rise to power and influence, however brief, did allow them to establish a lunar colony called Ramadas Khan. As the twenty-first century wore on, however, and the world's supply of oil became extinct, the TWC lost its power in world affairs. There is nothing more important on their global agenda than to regain their previous position of influence and control upon the world's economy and politics.

Phineas Kemp orders a surveying/prospecting craft (nick-named a "Snipe") to be dispatched from an IASA mining ship, the Astaroth. *The two-man crew of* **Peter Melendez** *and* **"Big Chuck" O'Hara** *guide the small vessel along an intersect course with the approaching object, armed with an arsenal of cameras and analytical instruments. Upon close approach, they discover that the object is an immense cylindrical spacecraft. Its dimensions are staggering: 320 kilometers in length, 65 kilometers in diameter. It is apparently an alien vessel capable of interstellar flight; it turns on its longitudinal axis, creating artificial gravity in the interior by means of centrifugal force. Colonel Kemp orders the Snipe to touch down on the surface of the alien vessel, and the maneuver triggers defensive mechanisms on the cylinder's superstructure which destroy the Snipe, killing its crew.*

If the alien ship, now titled Artifact One *by Colonel Kemp, contains an alien crew which may be hostile, they make no attempt to respond to the IASA's efforts to initiate communication. Aside from the destruction of the Snipe, the alien vessel is silent. All telemetered data from the Snipe's analysis is studied and IASA engineers determine the best*

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ways to overcome Artifact One's *defenses and possibly enter the ship.*

With the approval of the IASA's joint directors, an expedition on board the deep space probeship Heinlein *is dispatched to intercept* Artifact One *and attempt entry. One member of the crew is* **Rebecca Thalberg,** *a bio-medical specialist, who is aboard against the better judgement of Kemp because he and Thalberg are lovers and he fears for her safety. Also aboard the* Heinlein *is* **Ian Coopersmith,** *a black Englishman and tactical engineer whose specific mission is to neutralize* Artifact One's *defensive systems, and gain entry into the ship.*

This mission is successful, and while **Lt. Colonel Douglas Fratz** *and* **Lt. Captain Michael Bracken** *stay aboard the ship, the remainder of the crew, a landing party of six, enter* Artifact One *after figuring out the mechanisms which control its airlock system.*

Once inside the alien vessel, they discover an encapsulated world of jungle, forest, rivers, and plateaus—illuminated by a thick rod which hangs weightlessly along the axis of the gigantic cylinder. The flora and terrain appear to be an exact model of the Earth's environment during the Jurassic/Cretaceous Ages. Ian Coopersmith is in charge of the astounded landing party. He places communications officer **Alan Huff** *by the entrance hatch, and leads the others on a short exploratory mission.*

They quickly learn that the alien vessel is filled not only with plant life, but with dinosaurs as well. The crew is astonished to discover various species wandering about the terrain, and while watching a herd of iguanodons feed near the edge of a lagoon, their radio helmets pick up Alan Huff's cries for help. They return just in time to see the crewman torn to pieces by two meat-eating dinosaurs called compsagnathi. The scent of blood soon attracts larger, more ferocious carnivores, and the landing party is scattered in a panic-filled moment. **Doctor Amos Hagar,** *a popular exobiologist, is consumed by an allosaurus; two other crew members,* **Thomas Valdone** *and* **Doctor Gerald Pohl,** *are killed by two gorgosaurs.*

After witnessing the primitive carnage and death, Coopersmith and Thalberg, the only survivors, escape into the thick forest, since their chance of returning to the entry hatch is thwarted by the presence of predators. They remain hidden until the illuminating rod in the center of the cylinder grows dim, creating an artificial night. Nocturnal-feeding dinosaurs drive them deeper into the primordial forest and they quickly become lost.

Colonel Phineas Kemp, understandably shocked by the massacre of the Heinlein *landing party, orders Mission Commanders Fratz and Bracken to remain on board their ship and not attempt entry into the alien vessel until a follow-up expedition can join them. He is understandably shaken by what he has witnessed on the expedition cameras, but he clings to the hope that Rebecca Thalberg is still alive. He immediately begins organizing a second team to intercept* Artifact One *on board the deep space vessel* Goddard, *with Kemp himself as the commander.*

Also at this time, a meeting occurs between a blackmailed Copernicus Base

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director and an intelligence officer of Ramadas Khan, the TWC Lunar Colony. Information concerning Artifact One *is leaked to the Third World Confederation.*

As the Goddard *is prepared for launch, various scientists and engineers are speculating about the immense alien ship, which has now assumed the informal code name* Dragonstar, *since it is a starship filled with "the dragons of Eden." The most popular theory is that the vessel was an alien specimen ship, which visited our solar system approximately 180 million years ago, collecting a vast, representative sample of the flora and fauna of the Jurassic Age. Leaving our system, the theory goes, there must have been an accident which either killed or disabled the crew, or in the least, disabled the main engines. In this way, the* Dragonstar *became trapped in an eccentric, comet-like orbit which takes it around the sun once every 210 years.*

Meanwhile, time passes inside the gigantic, cylindrical ship, and Coopersmith and Thalberg struggle to survive. They have been unable to find their way back to the entrance hatch and spend several "days" wandering through the primeval forest. Coopersmith then suggests that the two of them make their way towards the distant end of the cylinder, where the ship's engines, and possibly its crew-quarters might be located. He reasons that if and when another expedition reaches the alien vessel, the astronauts will eventually investigate the engine-section of the craft. Coopersmith is an adept, resourceful man, whose knowledge of survival tactics keeps him and Thalberg alive. Although Rebecca has always respected Ian, she has never actually liked the man. Now that they are thrown together and must rely upon one another for survival, she finds herself becoming attracted to him. As they move through the ship's interior, reaching a plateau, they sight pyramidal ruins in the distance—something which suggests new variables, heretofore unthought of. Intrigued by the possible evidence of intelligent life in the interior, they strike out in the direction of the ruins. During this passage, Ian and Rebecca, sensing a growing need for comfort and intimacy, become lovers.

The deep space vessel Goddard *arrives at the* Dragonstar *with a crew of thirty experts. One of the* Goddard *team is* **Mikaela Lindstrom,** *a paleontologist to whom Kemp is attracted, despite his feelings of guilt concerning Rebecca Thalberg. The* Goddard *crew enters the alien ship, and sets up a base camp around the entrance hatch, using a force-field fence to keep any predatory dinosaurs at bay. Lindstrom begins a detailed study of the creatures, while the crew's engineers begin placing outrigger impulse engines on the* Dragonstar *with which they will break the immense cylinder from its cometary orbit and guide it into a stable L-5 orbit near the Earth. From that position, scientists can study the vessel at their leisure, and the IASA can marshal heavier forces to protect the vessel from the Chinese and the TWC.*

There is one problem with this strategy, however. The TWC is already at work with their own plans. A "sleeper" agent, **Ross Canter,** *has managed to be placed on the* Goddard *mission, and*

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at the appropriate time, Canter sabotages the expedition's communication gear, cutting it off from all contact with Copernicus Base.

Almost simultaneously, a group of TWC terrorists, led by **Marcus Jashad,** *hijacks an IASA mining vessel, the* Andromache, *while it is parked in lunar orbit. The TWC eliminate the mining ship's crew, except for its captain,* **Francis Welsh.** *Filled with one hundred trained guerilla fighters, the* Andromache *heads out to intercept the* Dragonstar. *Control of the alien vessel, and its secrets of advanced technology, will once again make the TWC the controlling force in world affairs.*

PART THREE

CHAPTER TWELVE

The illuminator pushed its light down steadily. Even if a scrap of cloud happened to obscure part of it, there was still plenty of hot, bright rod showing. Bloody little shade, too, mused Ian Coopersmith as he wound his way through a boulder-strewn pass. And what shade there was tended to be jungle, like being wrapped in a hot, smotheringly wet blanket.

He climbed over a large rock and then turned around to make sure Becky could manage. Though she didn't exactly leap over it, she didn't seem to need any aid. She was handling herself very well, Becky was, considering the fact that they'd been bumbling about in this monster-inhabited world-within-a-ship for five weeks now. Well, not bumbling, exactly, thought Ian. Close enough. At least they were alive.

Becky skipped down, flashed a brief smile and continued ahead of him, all without a word. Nothing unusual, that. They went without words for hours at a time, now, simply communicating through the odd body gesture or expression. It was as though they shared a certain state of mind that opened up an essential telepathy of survival between them. They functioned as a single unit now, in the rhythms of their walking, caution, food-seeking, sleeping, and . . .

Say it, Coopersmith. Spit it out, he told himself. Dammit, he had to come to grips with it, before it tore him apart.

. . . and lovemaking.

He rubbed the sweat from his eyes with the back of his hand, and took a deep breath of the strangely tangy air. Dust motes spun before him in their odd, primeval dance of physics. A stray insect buzzed somewhere near, unseen. Coopersmith put his legs into an imagined automatic state of left-right-left-right and watched as Rebecca Thalberg advanced along the path in front of him. Her movements were fluid, almost feline now. She'd recovered rapidly from the awkwardness she'd suffered at the beginning of their wanderings. Her muscles had hardened, she'd lost ten pounds in slightly over a week, and clearly she was adapting well to the situation. Oh, sure, she complained a lot, but that was release . . . an escape valve. In fact, at this point she almost seemed to accept their dilemma better than *he* did.

She certainly accepted the sex they'd gotten into better. These modern women, thought Coopersmith—particularly the

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Americans—know exactly what they want and when they get it, they have no qualms, no guilt.

Of course, in Becky's case, she had neither a spouse nor kids. That was part of what grated in Coopersmith's mind. He *loved* Leticia. Every time he made love with Rebecca, he felt, absurdly he knew, that he was betraying his wife. Marital treason, to say nothing of dispensing with all that his very strict parents had taught him. The fact that he enjoyed the blooming relationship with Becky, indeed *needed* it, did nothing to assuage his uncertainty. Having sex with Becky had nothing to do with survival, no matter how he tried to rationalize it. If they made it out of this place, what then? He didn't know if he'd want to lose Becky. He was falling in love with her.

One thing truly refreshing about the woman was the fact that the race business didn't bother her one jot. Coopersmith had grown up in a warm and loving home with racially mixed parents, whereas Becky's parents had been divorced early in her life. She'd barely known parental love, and she hungered for constant attention and affection. Just the sort that Ian was able to give freely and easily.

That they were still alive to share any kind of relationship was a tribute to their resourcefulness and their ability to learn the rules of the environmental game as it was played in the late Jurassic. They'd spent three days among the ruins of the three pyramids, but found no clues as to who might have built the structures or to what purpose they might have served. All attempts to find an entrance into the pyramids had been failures. They'd deserted the ruins to make their way across the lowlands of the river valley, following the topography as it gradually ascended to the edges of a great plateau, which was less foliated. Lots of rocks. Mountainous. Coopersmith definitely preferred it.

Becky stopped, and Coopersmith ran into her.

His lack of sufficient reflex action troubled him. What was it? Getting tired, old boy. Getting soft? Old?

"What's that, Ian?"

Coopersmith disentangled himself, and looked toward what she pointed at.

"My god," he said, forgetting all his previous preoccupations. "I think we're on to something this time."

A city.

Or what appeared to be a city, at any rate. Coopersmith stood by her side and stared into the afternoon haze, just distinguishing the collection of rectangular structures in the distance.

"Looks a bit like some South American ruins, Ian. Terraces! Stepped terraces. I can't really tell at this distance, but it looks like they're overgrown with vegetation."

"*Chariots of the Gods!*" Ian intoned gravely.

"Oh, come off it."

Coopersmith folded his arms in contemplation. "No. Really. Do you think that von Däniken chap had something on the ball? Obviously Earth *was* visited by folks from another planet. The people who made this ship, as a matter of fact!"

"Yes, but that was millions of years before Däniken and the other screwballs say *their* aliens visited Earth."

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"But they *were* right in principle, you have to give them that."

"I rather think all this is a little more amazing than what they had in mind." She gestured expansively about the inside of the ship.

Ian glanced about. Yes. It was still a bit mind-numbing, staring at all this. *An entire world on the inside hull of a gigantic starship. A world of dinosaurs, of ruins, of long-kept secrets.* The horizons rolled on up into the haze on either side of them, and the illuminator burned steadily in the center of the cylinder like a very long filament inside a very big vacuum tube.

"Just the same," Becky continued, "one comes to accept it, if not grasp it."

"You'd bloody better accept it, or you become a between-meal-snack for one of the carnivores, like the rest of the party," Ian commented.

Becky said, "Do you think we can make it by nightfall?"

"Is that all you think about, woman?"

She stared blankly at him, then hit him lightly on the arm. "You know what I'm talking about, Ian."

"I don't know," said Ian, seriously, as he checked his chronometer. "Hard to say how far away it is. And there's a lot of open territory between here and there. We would have to be very careful."

Becky nodded, then looked back towards the ruins. "I think we should chance it. If we make it, there will be plenty of places for cover. I'm sick of finding the tallest trees, to say nothing of squirming into cracks in the rocks."

Ian smiled. "If you think you're up to it, my girl! But don't say I didn't warn you. We've been lucky so far, you know."

Since they had travelled up from the lowlands, they'd noticed a gradual change in the kinds of creatures which inhabited the highlands. The big hadrosaurs and the even bigger sauropods such as the brontosaurs were not in evidence in this part of the interior because of the scarcity of large lakes and marshy swamplands—their natural habitat. Consequently, the types of predators which feasted upon them were not seen as much, although Ian had noticed that a smaller species of gorgosaurs seemed to have no territorial preference. He'd taken note of the prevalence of the more sturdy types of herbivores in the highlands, having seen large herds of ceratopsians, ankylosaurs and other four-legged dinosaurs which affected thick, rhino-like hides and a vast array of spikes, horns, and armor-like plating.

You never get used to looking at those things, thought Ian Coopersmith. *Any* kind of dinosaur was frightening, not merely because of their potential danger. They sparked some primordial fear . . . a very basic instinct. And they seemed so *alien*, even though they did originate on Earth.

He'd read the theories concerning the relationship of lizards and mammals. The smaller, weaker mammals were no doubt prey to the last of the dinosaurs. Hence, to escape from the saurians' night-stalking habits, mammals were thought to have searched out nooks and crannies and caves and high trees, just as Ian and Becky had been doing these past terrifying weeks. There, in partial safety from their natural enemies, they developed a way to keep still for long

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periods of time. Sleep. At frequent intervals, they needed to rouse, enter a more aware state of repose. Dreams. And what would these first mammals dream about? Why, about the creatures who hunted them, of course. Dinosaurs. Dragons. The beginning of an archetype. Somehow, that archetype, whether genetic or truly part of the "collective unconscious" as Dr. Jung had thought, had travelled through the eons and lived now in Ian Coopersmith's head. Coopersmith knew it. Travelling through this hellhole with its attendant natural demons was bad enough. When he slept, though, it was truly torture. Nightmares would emerge from the gunk of his unconscious mind, and reach out with razor claws or needlelike talons to tear and rip. Dead, icy, reptilian eyes would glare into his, bloodshot with rage and hunger. They would chase him across plains, and through swampy jungle, these terrible lizards, and they would catch him and rend him and consume him, just as their brothers had done to poor Huff, and Hagar, and Pohl, and Valdone with the wife and the mother and father who grieved. But he would never die. Like an endlessly repeated film clip, it happened over and over, over and over. . . .

Shuddering, Coopersmith realized how parched his throat was. He took a swallow of water from his canteen. Not too much, since it was hard to say when they'd see their next natural spring or stream with decent drinking water. Though it satisfied his thirst, somehow it didn't do much for the dryness.

Ian Coopersmith had to admit to himself that he was frightened to the very roots of his being. Becky didn't seem to be having as many problems as he was. To begin with, she had no shame about her fears. Her emotions were expressed readily, in tears or screams or whatever. And she had someone to rely on, a caretaker. In Ian she no doubt saw a trustworthy father-figure. Her competent hero, able to take care of all situations at all times. Was that why they were lovers now? If they'd been thrown together in a less dangerous situation, would she have been cold and aloof?

He *did* feel extraordinarily protective of her. Another instinct, or was it love? Where did passion and need end, and true unselfish love begin?

Because of her obvious trust in him, he was afraid to show the fissures of weakness with which he felt himself riddled. Oh, he could tell her he was scared from time to time, but somehow she never believed him.

He didn't want to die, but he didn't know how much longer he could endure this internal and external pressure. He watched Becky walking ahead of him for awhile, almost envying her. He wished *he* had a competent father figure. Somehow, all the responsibility to get them out of here alive seemed to be on his shoulders.

As they passed a large outcropping of rock which Ian rather fancied looked like a half-finished sculpture of a stegosaurus (*Dammit, man, stop thinking of the things. You've got dragons on the brain!*) Becky pointed out across the plain. "Ian. Look!"

There was a small "family" of chasmosaurs within 200 meters of their position. The group of stocky animals looked suitably fearsome with their heads covered with a large fan-shaped,

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bony sheath, further adorned with spike-like horns. The largest of the beasts was more than two meters high and twice that long.

"God bless. Thy're kind of close, aren't they? We'd better lie amongst these rocks until they've put some distance between us."

He grabbed Becky's hand and led her back into the jagged stand of boulders, keeping his eyes on the chasmosaurs. They climbed the rocks, and Ian could feel the trust in the warmth of her grip. She no doubt found his hold strong and reassuring. She probably was falling deeply in love with him, and obviously didn't want to stop herself. Despite Phineas Kemp. How easily people followed the whims of their heart despite their commitments. Coopersmith wondered if Kemp would understand. He knew that Leticia would. "Come now," she'd say. "The old deserted island bit. A virile man and a lusty woman. I'd think it unnatural if there wasn't a little hanky panky." But even hearing her reassuring voice in his mind didn't assuage Coopersmith's guilt much.

They'd talked about their respective commitments, and Coopersmith could almost understand why Becky had fallen so easily for his natural warmth. Apparently old Kemp wasn't only a cold fish in his command duties. One of Becky's pet themes of conversation had been her frustrations with Kemp, and though Coopersmith never failed to stick up for the man, inwardly he was astonished. Did drive and ambition do that to a man's capacity for love and intimacy? Coopersmith wondered if it was worth it. In fact, he questioned the value of his own meager ambitions, which had vaulted him to his own high level in the IASA, but had also landed him in *this* mess. Perhaps he should have been satisfied with a plain old Earthbound engineering job, and lived a long and healthy life in comfortable contentment.

They'd spilled much of themselves into each other, he and Becky had, and now he was irretrievably caught up with her. She thrilled with the time and energy he took in trying to understand her from the very beginning, despite the lack of success in their first bout of love-making. That had been kind of rough, that had. He'd apologized for seducing her, for letting his drives get the better of him, and promised that it would never happen again. But she *wanted* it to happen again, just like he did. And after a couple of days when guilt had put a barrier between them, she explained that she felt guilty as well, and that perhaps they should work through that guilt, because the comfort they could take in each other, physical and emotional, might be the key to the will to survive. He couldn't argue with that, nor did he want to, and the subsequent sharings of their bodies and minds had proved extremely sustaining for her, and for him as well, on certain levels. But the guilt and the doubt remained. He was holding back, he knew, because he realized just how possible it was to fall totally in love with her, and he didn't want that.

Movement in the chasmosaur herd distracted him from his unsettling thoughts. "Oh, oh. I think they've picked up our scent."

The dinosaurs were becoming agitated. The one closest to them had begun

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to nervously pad the ground with its front feet.

"Damn," said Ian. "I think that big one's coming this way." A thrill of fear raced through him. He was in no state to deal with this.

One of the things they had learned about the ceratopsians since they'd reached the highlands was the difference in temperament between the tough, rhino-like dinosaurs and the fleshy herbivores of the lowlands. The horned dinosaurs, although plant-eaters themselves, were a scrappy bunch who did not scare easily and who would willingly put up a fight against any predator that threatened the safety of their young within their herd. In fact, Ian and Becky had seen the large males inexplicably charge inanimate objects such as rocks and trees with bone-shattering impact.

Becky looked up at him. "Ian. Are we safe here?"

"God knows . . . but I think we're going to find out. Here he comes!"

The largest of the chasmosaurs had begun trotting towards their position, gathering speed quickly, kicking up clouds of dirt in its wake. The resemblance to the head-on charge of a big rhino was uncanny, although those mammals were a lot smaller than these bastards.

A knot of fear crawling up his throat, Ian took out his Magnum pistol and flipped off the safety, checking the chamber. The weapon was fine. Coopersmith wasn't. His hands were trembling slightly.

"I'm going to wait until he gets close enough for these slugs to do the most damage," he said, swallowing back his fear.

Steady on, old boy, he told himself. Keep your nerve.

When it was less than 50 meters away, it appeared to have reached its full speed, which was considerable. The air reverberated from the ground-thudding rhythm of its charge.

Suddenly, with incredible volume, it bellowed.

Startled, Ian took a step back, swiftly. He felt the rock behind him dig into his leg even as he lost his balance.

"Jesus!" he cried, tripping over the hard rock. Trying to recover, he twisted around, forgetting his hold on his gun. The weapon flew from his hands into the dust even as he windmilled over into the short drop behind him. He fell a meter and a half, hitting hard on his side. The fall knocked his breath out, and he gasped in pain.

Must get up, he thought, dazed. *Becky. Must watch out for Becky.*

He rolled over. Agony shot up his ribs and one leg. He tried to scramble up, but he'd sprained his left ankle and he tottered back down again, grabbing hold of the rock that had tripped him. There was the taste of dust and blood and death in his mouth as he saw the chasmosaur, honking wildly in its unnerving bellow. It was closing the distance rapidly, its head down so that the large horn on its nose was pointing straight ahead. The fanlike sheath of its bony head-crest served as a shield for its softer neck and sagging underbelly. It looked like an armored car bearing down upon them.

Becky, however, was not standing still. She had already dashed over to where the gun had fallen, and retrieved it.

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"Stay down, Ian," she said firmly.

"But Becky . . !" he said, trying to clamber over the rock.

"I said stay down, dammit! No time!"

Becky wedged her right hand between two jagged peaks, taking careful aim down the short barrel of the Magnum.

Ian watched with a mixture of fear and astonishment, forgetting the pain that licked up his leg and his side, ignoring the ache that had begun to pound in his head.

Becky sighted between the rocks, concentrating on the expanding shape of the chasmosaur's triangular head. Just below two bony projections on its brow were two small black beads—its eyes. Becky was obviously going to try to put a bullet into its brain through an eye-socket. There was no way of knowing if a magnum slug would even penetrate the armored skull. Her chances of hitting the tiny eye, though, were slim. Especially since the beast was moving so fast.

When it was twenty meters away and closing, Becky fired her first shot. It struck the fan-like sheath, shattering it like a dinner plate. Ian had underestimated the destructive force of an exploding slug. He was shocked to see the beast momentarily stagger as its blood pumped through the wound and down the side of its face. It shook its head and resumed its charge as Becky fired again. This time the bullet entered the thing's mouth just below the curve of its bird-like beak. Bits of bone and a thick mist of blood spurted from its lower jaw. The beast stumbled down upon its front legs, shaking its head violently from side to side. Its bellow reached a higher pitch, and the sound pierced the air, describing the beast's agony.

"Good Christ!" said Ian under his breath as he watched the hulking creature force itself back up to its feet and begin to again move forward. He felt shattered with fear and helplessness. It was all in Becky's hands now. There was nothing he could do.

Nothing.

The chasmosaur's ugly head was now mottled with blood and dirt. Its lower jaw dangled open helplessly.

But still it kept coming.

Less than ten meters from their fragile position in the rocks, the Chasmosaur's speed had slowed to a fast walk. Still, it was moving with enough power to barrel on through the rocks by the sheer force of its own momentum.

Ian watched Becky as she drew a breath, sighted again down the barrel, and waited until the monster's enormous head was thrashing and weaving only meters in front of her. Ian could smell the lizardy reek from the creature, mixed with the dust it had spumed up.

Her face was calm and intent.

She fired twice. The first volley struck the horny crest, further obliterating it. The second slammed straight up into the beast's open mouth, which had been thrown back and up by the explosive force of the first slug. The second bullet must have entered the beast's brain through the roof of its mouth because in the next instant Ian saw the back of its neck, just behind the ridge of its bony crest, explode in a geyser of shredded flesh and vaporized blood. The chasmosaur's bellowing stopped abruptly as it fell forward, its

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ravaged head falling into the wedge of rocks where Becky had been firing from. Jumping back, Becky fell and tucked into a tight roll.

Ian cried out and managed to scramble over the rocks and over to her, ignoring the shafts of pain driving through his body. As he touched her, he looked up. The beast's great head hung over them, unmoving, finally stilled. Blood dripped down the rocks, pooling in the dirt.

"It's okay now, Becky," he whispered.

She opened her eyes and stared up blankly.

"You did just fine, darling. You saved our lives." He pried the Magnum from her hands, and switched the safety back on. The thing was hot from firing.

"Ian! Oh, God. Ian . . ." she said, reaching up for him.

He held her for a moment, trying to ignore the pain it caused him in his ribs. He just prayed he hadn't broken any.

"You were incredible, Becky," said Ian, stroking her hair. "I'm sorry I doubted you."

"What do you mean?"

"Nothing. Let's not talk about it . . . not now. Are you all right?"

"I think so. He didn't touch me. I just lost my balance getting out of the way. What about the other ones?"

Ian stood up and looked beyond the huge head of the dead beast, down to the plateau where the remainder of the small herd continued to graze. He favored his injured leg. "Hmm. Doesn't look like there's anybody else who wants to play hero. Just the same, I think we'd better get out of here. This corpse's going to start attracting scavengers."

"Ian, your leg . . ." Becky got up, concerned.

"And my side and my head, too."

"Hurt much?"

"You bet. That was a damned stupid thing I did back there. I should have stayed calm. I don't know what the hell is wrong with me, Becky." He looked away, feeling the full burden of his failure.

"Hey. Just a moment here. You fell over a rock. I shot the dinosaur instead. So what? You're not going to do the male ego trip on me like Phineas does."

"It's my responsibility to look after you," he muttered.

She walked around and faced him, hands on hips. "Listen, Ian, we look out for each other here. That's the way we survive. I'm not exactly as strong as you are, and maybe I don't have all the training you do, but I can do my share."

"Obviously."

"And because you didn't get to blow the beast away, your precious ego is stung."

"No. Maybe that's part of it, Becky. But there's more than that. I'm not like Kemp. I promise."

Her voice softened. "Can you walk all right, Ian?"

"Sure. It feels better already."

"Well, we'll never make that city before dark now."

Ian said, "We'll have to work our way across the plateau using whatever cover's available. And find a place to rest tonight. I don't suppose there are aspirins in our survival packs?"

She grinned. "I brought some Midol."

"Not exactly issued medication, but

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it will do. I wish I had a shot of Scotch to take them with."

"Just think. If we can stay alive, you can have all the Scotch you want."

Ian pursed his lips thoughtfully. "You know, finally I've found something to live for!"

She laughed and took his hand and helped him out of the rocks. They travelled across the open land in a direction opposite that of the chasmosaur herd.

Ian Coopersmith thumped down wearily beside Becky, who lay prone at the edge of the clear stream that flowed swiftly down the slope. His chest still smarted, but it was obvious that nothing had broken. There were bruises there, but that was all. It was his ankle that mostly gave him trouble, slowing down their progress quite a bit. If they ever had to run . . . well, he didn't know *what* would happen then. He moved his hands to his forehead as though to push away the remainder of his headache. Becky's tablets had been surprisingly helpful. However, some of the pain still remained.

His pantsuit top *squished* with his movement. The thing was sopping with perspiration. He had long since become accustomed to the sting of sweat leaking into his eyes, to say nothing of the aroma that clung to him. God, how he stank! Growing up in a self-respecting lower-middle class family in the East Acton section of greater London had drilled into Ian Coopersmith layers of Western living discipline, to say nothing of English manners. Although in the tidy household by Wormwood Scrubs cleanliness was never next to godliness—that had a whole upper stratum to itself—it was close enough to merit threats of hellfire and perdition if not attained. Even now, should he suddenly be miraculously transported to the bosom of his dear family, his mother would wince and his father would take the familiar pipe from his mouth and point it imperiously upwards toward the spotless bathroom, wordlessly demanding an immediate ablution of his formerly missing flesh-and-blood before hugs and kisses were extended.

Dammit bloody all! How could a man keep his dignity when filthy and smelly? He would have worried about offending Becky if she weren't having the same difficulty. Still, since she had never affected a flossed-up hairdo, nor had she worn any make-up before, the change in her appearance had not been as devastating as it would have been in some artificially attractive women he knew. No, if anything, her present state—hair straggly and mud-matted, jumpsuit dirty as his—gave her a rather appealing look. "Earthy!" he had pronounced once when she'd asked him if she looked as perfectly awful as she felt, and she'd smacked him playfully, chuckling.

"I take it you've decided that the water is not poisonous," he said, mixing his words with a prolonged sigh.

Becky stopped slurping. She canted her head to look at him. Water dripped down her face and hair, back into the stream. "Oh. So that's what I am, huh? Your wine taster."

"Dear Rebecca," he said in his best stentorian baritone. "I'm glad you've found your rightful place in life. Pray tell, how *is* this bountiful vat, vintage 150,000,000 B.C.?"

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"Here," she replied. "Try some yourself, oh mighty king!" Cupping her hands, she splashed up a good pint's worth of water straight into Coopersmith's face. The shock of the cool refreshing stuff left him spluttering comically. Then it reminded him of how very thirsty he was, and how some chill liquid running down his throat might take him away for awhile from this dreadful humidity.

He knelt down and drank.

When he rose, quenched, Becky was sitting, legs and feet dangling in the gurgling stream. "Oh, Ian. I could linger here for days."

"Yes, well, may I remind you that there are certain fanged and clawed beasties afoot hereabouts who would just dearly love to stumble across us and have some human flesh along with their gulp of fresh water. Very rare stuff, human flesh. I've developed this paranoid notion that the roaring critters have developed quite a taste for it."

"You really think that we'll discover shelter in that city?" Her eyes were closed, her features the very model of resignation.

"I haven't the faintest. But I know we *must* push on." No irony of phrase twist in that; he was serious. He wanted to stay here as much as she did, if only to rest his leg.

She stretched out her arms and yawned deliciously. "Why must you be always right? You remind me of Kemp."

"Becky, we're not in a world of right and wrong now. We're in a world of *alive* and *dead*. I don't think there's any necessity to lecture you on *that* subject."

"You know, I like you."

"That proves you're still alive."

Playfully: "Oh, and if I didn't like you, I'd be dead?"

"Only in spirit, oh thou of excellent taste."

Becky opened her eyes, and suddenly all Coopersmith wanted to do was to stare into them for a long time, forget his pains and anxieties. But the eyes were averted now, staring into the stream as though to memorize its pleasures.

"You know, Ian," she said slowly and thoughtfully. "I used to think—oh, *eons* ago it seems—that without all the paraphernalia of structured civilization about me, without my family and friends, and TV and music . . . well, without all that, life just wasn't worth living. In fact, back ten years ago when the threat of a nuke war with China was about as close as it ever came, I chose to attend school in Washington D.C. not because I particularly cared for Georgetown University, as nice as it is. No, I thought, if there ever *is* a nuclear holocaust that wipes out modern civilization as we know it, with only a few radioactive humans left to show for the old gene pool, *I* want to be right under that first bomb and go out"—she snapped her fingers briskly—"just like that. No moaning or mourning. No struggle for wretched survival, no weeping for lost pasts or loved ones. But you know"—she turned to him, and he got what he was hoping for; a chance to stare into those very lovely eyes—"you know, Ian, all that time, I was *wrong*."

"Oh? How so?"

She grappled for words in short movements of hands and fingers. "I mean . . . I mean, these weeks

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here . . . with you. Why, they've been *miserable* and horrifying and just dreadful—"

"Oh, thanks."

"No. You see, despite all that, I'm *alive*. And I know I'm alive, I'm aware that I'm alive; not walking through a daydream schematic of work and socializing, hitting other people's keys and letting them hit mine. I'm *alive* and when I eat food I *taste* it, and when I drink water it's the most satisfying drink I've ever had. And when I see you, Ian . . ."

"Yes?" The feeling in that word was invested naturally.

"Well, I know who you are, more than I've ever known anyone else before. I . . . I . . . oh hell, I can't explain, dammit!"

Solemnly, Coopersmith said, "You don't need to explain, Becky. I know exactly how you feel. About all of it."

That excited her. "You mean you were like that too? I mean, so dependent on civilization?"

"I suppose so. I suppose we all are, aren't we? I must admit, though," he chuckled lowly, "if the bomb ever dropped, at no time did I particularly want to be under it."

She didn't notice his sarcasm. Indeed, she hardly seemed to be listening to him at all. "No, I've never felt so alive. And you know, I want to survive. I want to keep on living and living, and growing and discovering. And I know, now, I'll never be bored again."

"That's something in small supply here, that's for sure."

"I'm almost glad this happened. Is that a wretched thing to say, Ian?"

"I think you've got illuminator stroke, dearie." Somewhere a strident and hungry cry split the silence of the rocky plain. Coopersmith paused for a moment to listen. "And if you want to keep on knowing what life feels like, we'd better keep moving toward what appears to be our only hope."

Again, she didn't seem to be paying attention to what he was saying. Instead, Rebecca Thalberg was staring dreamily again at the water, sheened with the brilliant reflection of the streak of light that spread from horizon to horizon.

"Becky, dear, are you thinking what I'm thinking?" Coopersmith said slowly, savoring the emotion of his words.

Licking her lips, she looked down at the shallow stream. "I don't see any of the usual fauna around this water . . . or under it. Not like everywhere else. Oh, I'd love . . . I think it's worth the chance!"

"Right!" Coopersmith said cheerfully, beginning to unbuckle his belt.

However, Becky paused only long enough to take off her shoes before she leaped, fully clothed, into the water, splashing merrily.

"Oh, hell," said Coopersmith, dropping his gunbelt, shuffling off his shoes and joining her immediately.

The water that folded over him was crisp and cool, bracing and refreshing.

It felt wonderful.

"Well, at least our shoes are dry," said Becky.

Coopersmith hitched up his backpack for better balance, and grunted in reply. Their clothes were taking an awfully long time drying in this muggy heat. Not a frightfully pleasant sensation, slopping around in wet clothes, in this

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kind of wretched climate. All the same, he had to agree with Becky: the clothes were much cleaner now.

And they both smelled better, if that mattered.

They were still keeping to the rocks and the trees, away from the long plain where the bigger beasts roamed. They were making less than excellent time, however, due to Ian's ankle. Limping was not the best form of travel. By Coopersmith's estimation, they had a good two hours or more of illuminator-light before that great rod in the sky called it a night and the dinosaurs began to prowl in earnest. That gave them an hour and a half more to march, and a half hour to find some place that looked reasonably safe in which to hole up.

To think that the Earth had been like this for millions upon *millions* of years! From this steaming stew of life had emerged mammals and subsequently human beings. Ian had always felt a gentle *oneness* with nature and physics. His expertise in mathematics gave him the language to express that, and his engineering capabilities to form his statements. But here, in this primeval form of nature, his own heritage, he felt alien. Out of synch. The ecology here may be perfectly balanced, but it seemed to be no place for the more advanced beings that this very environment eventually created. Out in the middle of a land filled with monsters whose sole purpose in life seemed to be to kill and to eat, he could empathize with the first mammals in their fight to stay on the right side of saurian stomachs.

He hoped his ankle improved. He used to travel with a clean efficient stride. After a few wearisome days, he'd taught Becky to move with a similar economy of motion. Now, her first week of aches and cramps gone, she was able to keep up with his normal pace easily. Though her legs were shorter, she was lighter and more agile. Now, trailing behind her, Coopersmith was enjoying watching her. Her movements gave him a certain aesthetic pleasure. The constant reminder of her company displayed lithely before him, feminine sleekness and all, reinforced his own inner supply of security. He'd made sure she knew that. They had learned to give those sort of things to one another, and to accept. The relationship worked smoothly, in that respect.

Through narrow gullies, over stands of scrub-trees, around craggy rocks, they walked, always skirting the plain which afforded no protection. From time to time, Coopersmith caught peripheral, but distant, glimpses of dinosaurs, convincing him of the wisdom of this path.

Only fifteen minutes short of lights-out, they located a tiny crevasse with an overhang they could use to conceal themselves. The entryway was narrow enough to prevent any large head from squeezing through, if its owner was smart enough to find them, which Coopersmith doubted.

Becky tucked comfortably against him, their spare dinner of well-done lizard flesh and fruit digesting within his stomach, Coopersmith kept the first watch. The Magnum in his right hand gave his mind ease. Rebecca, breathing softly in sleep against his body, however, supplied him with true repose.

* * *

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She'd always enjoyed ruins.

Since her childhood, Rebecca Thalberg's idea of a wonderfully adventurous day-trip was to seek out some old house or fort and wander. England and Europe had been a trip of perpetual bliss. She'd always felt that houses somehow stored up the impressions of the times and the people they'd been through. To walk amongst the remains of a very old establishment built by human beings was to somehow touch them across the gap of decades or centuries. In the tower of an ancient castle, say, or in the rocks of the foundation of an old New England home, mossy and blackened with age, there was a feeling of knowing something of the people who'd put them together, who had used them for shelter.

The ruins of the old city were different, however.

Certainly, they carried their own unique vibrations. Superficially, they resembled some of the assembled stones and mortar that Becky had encountered before on Earth, if only in shapes and material of the structures.

But they felt quite alien.

"You think they're all dead?" she asked Ian, surveying the expanse of one of the crumbling, viny pyramidal forms.

"Hmm?" Ian was too busy examining the rune-like carvings in the side of a jutting bit of stone. Pictographs composed part of the message. Characters of some language consisting of what appeared to be bird claw scratchings composed the rest. Coopersmith had long since given up trying to discern the meaning of the scratches. He was now concentrating on the sequence of sketches, trying to determine if they were supposed to compose a series of related thoughts that would reveal something of the creatures who'd drawn them.

"Whoever built all of this. The species I mean. Obviously not human."

"What brings you to that conclusion?"

She shrugged. "Oh, just the texture of this place. The feelings I get here."

"Ah! How I love the logic of a woman doctor of science."

Only her familiarity with Ian's brand of understated humor checked her anger. She actually found his statement amusing. Being with him all this time, she'd actually begun to be amused at herself. Just think. Intense Rebecca Thalberg, torpedoing through life, now able to chuckle at her own inner paradoxes, her absurdities. How that would please her father.

"You know what I mean, damn you, Ian."

"Absolutely. These pictographs, for example." He fingered one of them thoughtfully, tracing the simple two-dimensional figures. "Obviously they do not depict humans of any kind."

"That doesn't necessarily mean that they weren't—"

"Correct. But notice that these figures are pictured in various poses. They hold things in their hands. Weapons. And these bowls here, with what looks like smoke issuing from them. They know about the uses of fire. Ergo, it's reasonable to conclude that the artists were drawing self-portraits."

"Ian. They have *tails*."

"Quite."

"You think—"

"That these are the creatures—or the

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sort of creatures—responsible for building this spacefaring terrarium?''

''Something like that.''

''Precisely my conclusion. It's a possibility. No more, no less.''

''Something goes wrong with the ship. It's stranded in our system and those operating it are forced to live in this encapsulated environment, reverting to savagery and then working their way back. . . .''

''So where are they now?''

''I was just suggesting possibilities.''

''Just so.'' He squatted down to examine the lower layer of pictures. ''Now this sequence here. I don't know if you're supposed to follow it from left to right or right to left or even if it's a *sequence* as we understand the meaning of that word. But it appears to depict some sort of ceremony. The pouring of the fire. This pattern here . . . the two creatures in some kind of dance.''

''Religious?''

''Sexual? A fertility rite? A prayer for good crops or to protect them from their less intelligent though more savage counterparts?''

''You know, that may be why the aliens wanted a bit of Earth as a sample. Perhaps the similar lines of evolution. They wanted to study . . .''

''Whoa! Just because they seem to have long tails doesn't mean that they're lizards, dearest.''

''Maybe.''

Ian turned his attention back to the inscribed pictures.

''Perhaps it's just a big Saturday night shindig.''

Ian glanced at his watch. ''Speaking of night, I do believe we've got one coming on in about an hour. I think we had better find that shelter we've sought here, old girl.''

''Yes, and maybe gather up some wood for a campfire to cook with. I'm ravenous!''

They had hiked another half a day without incident, somehow able to avoid the other hungry denizens of this shipworld before finally reaching the ruins of this ancient city. They had managed to beat their way through the overflowing vegetation that thrived so well on the remnants of civilization. They had passed dozens of dilapidated huts and houses, heading instead for the nearest of the pyramids, operating on the assumption that any written remnant of intelligent life would be kept in what was obviously some kind of monument. And they'd found that remnant, worn and vine-covered as it was, to Ian's immense satisfaction.

Ian was a bit of a puzzle to her. He was as much a mass of paradoxes as she was. Sometimes he seemed to thrive on this whole experience, somehow keeping his mind detached enough from the struggle to survive to operate on the sifting-through of all this fascinating information. Other times he was just barely able to cope. That death could be very close indeed obviously weighed on his mind, and yet it was also obvious that he was much more concerned with Rebecca Thalberg's life than with his own. That was something that was new to her after her long involvement with Phineas Kemp who, when not involved with himself, was preoccupied with that holy extension of himself, the good old IASA.

The love that Ian Coopersmith gave, when he was able to deal with his guilt,

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was a natural thing, asking for nothing in return, only giving. That was a new experience to her. It was only natural for her to respond in kind. The actual easy acceptance of the giving by him was surprisingly satisfying.

No, Ian Coopersmith wasn't like Phineas Kemp at all. And she was glad of that.

"What say we climb up toward the top," he said, looking at the peak of the terraced monument. "Even if we don't find an enclosure to hide in, I don't believe any of the nasty critters will be able to reach us up there."

"Right."

They gathered some firewood. Then they began to pick their way upwards, scrambling over eroded fissures in the stone, scrabbling up the mounds of rubble that afforded pathways. At one point, they had been forced to use some roughly chiseled handholds to get up the short but steep face of one of the levels, tossing their dried wood up first.

Finally, exhausted, Rebecca protested. "Hey, listen . . . there are only two more levels. Isn't this high enough?" She pointed to a large cleft nearby in the face of the structure. "We can even use that place. How about it?"

"Sounds reasonable to me," said Ian. "As a matter of fact—" He paused, staring into the distance. "Great Jesus, look at *that!*"

"What is it, Ian?" She followed his pointing finger and saw something less than three or four kilometers distant.

That it was not a natural formation of rock was obvious from its uniform shape, its symmetry from slope to mist-touched slope of the cylinder walls. Though it was a bit too far away to make out precise details, there could be no doubt that it was an artificial structure that appeared to *ring* the interior circumference of the cylinder.

A wall.

And beyond . . .

In the dim distance, everything *ended.*

That was why the illuminator looked so odd as it tapered off. This was the point at which it stopped, the point where it connected with whatever engine or mechanism that powered it.

Everything else was just dimly blank. A great expanse of grey, non-reflective material, presumably some sort of alloy.

"I do believe that we may have found our intelligent inhabitants of this place," Ian Coopersmith muttered, almost to himself.

"How can you be sure? I mean, this structure is here. And I don't see any intelligent beings wandering about." Becky remembered her visor. She pulled off her pack, rummaged around inside, found it, and fitted it around her eyes.

Coopersmith followed her example. "Yes. Much better." He pointed, making a sweeping motion with his arm. "Assuming it is a wall—or at least some kind of barrier—evidently its purpose was, and hopefully still is, to keep the carnivores of this world out."

"Granted."

"Fine. Now, what do you immediately notice?"

"It's *long.*"

"Yes, it must be. Actually what I meant is that there don't seem to be any breaks in it. Any wall that is not maintained will wear away, especially in this kind of climate."

"You're saying that it follows that

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there must be somebody behind it to make repairs?"

"Absolutely." Ian smiled as he commenced gathering the wood and readying it for the campfire. "And we're going to meet them tomorrow."

Had the tyrannosaurus been lying on a plain, there would have been no problem. Thalberg and Coopersmith would have given it a wide berth. However, as it lay quite still amongst a scatter of rocks and boulders, its thick grey hide camouflaging it perfectly with the surroundings, Becky almost stepped on its tail.

"Oh God." She managed to stifle a yelp.

Coopersmith fought to control his instinctive panic. This pile of muscular, baleful death here was the stuff of nightmares. Only it was *real*.

The behemoth stirred. Two tiny lizards, evidently feeding on parasitic mites and insects that covered the beast's thick, almost corrugated hide, scampered away into the shadows. The great mouth opened as though with a yawn, revealing a mouthful of jagged, sword-like teeth. It slammed closed with almost a pneumatic hiss. Ian Coopersmith got a whiff of rotting meat, nestled uncomfortably amongst the lizardy musk the monster exuded.

Fortunately, the tyrannosaurus seemed torpid.

This one seemed to have recently fed; its underside protruded beneath it, as though it were pregnant.

Its proportionally tiny forelimbs were stretched forward, and its head was laid down so that the jaws rested on the ground. Its eyes were closed, and its great body heaved regularly with bellows-like breathing.

"All right," Coopersmith said, cursing his luck. Only about a third of a mile away from that wall, and they had to run into Mr. T. Rex. Still, if they could skirt it, they'd be okay. "Steady, dear girl. Back off slowly, with as little noise as possible."

She obeyed as soundlessly as she could, keeping calmer than he felt. As they moved, he unsnapped the holster of his gun.

Suddenly, the great, ugly, veined nostrils flared wide on an inhale of breath.

Its greedy eyes fluttered open, immediately catching sight of the two backing away from it.

"Oh, shit," said Coopersmith.

Rebecca stopped, paralyzed. "Ian.We can't kill *that*. . . ."

The tyrannosaurus recovered awareness with astonishing speed. Its vast bulk moved to rise, faltering.

A ray of hope broke into Coopersmith's mind. Of course. There was maybe eight tons worth of dinosaur lying there, prone. Most of its muscle was devoted to its incredibly thick neck and its haunches. As it moved to get up, though, it was obvious that the forelimbs—about the width of human thighs, tapering down to two clawed fingers—had their definite and very important purpose.

As the massive hind legs pushed hard, the flexed claws were digging into the rocky soil.

If not for those small forelimbs—

Even before the final thought entered his mind, Coopersmith raced forward

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toward the beast, the pain in his ankle awakening.

"Ian!" cried Becky, startled. "Ian! No!"

He stopped about five meters away from the struggling beast. It roared with fury as it saw its intended prey approach, and increased its efforts to rise, flinging its great tail out to help balance.

Coolly, Ian Coopersmith brought the Magnum up, switched off the safety and carefully aimed.

He squeezed off three rounds.

CaRack!

The bullet exploded into the forelimb in sight, tearing away a huge section of flesh. Blood pulsed and sprayed.

CaaaaaRack!

Just below the other wound, a larger wound opened, revealing the white of bone.

CaaaaaRACK!

The snap of the bone was audible, even mixed with the loud scream of the tyrannosaurus.

Just as Ian hoped, it instinctively redoubled its plodding efforts to rise. Only in doing so, it put its eight tons on a shattered limb, throwing it entirely off balance.

With a roar of outrage and pain, it fell to its side.

Ian about-faced, and began to run in the direction they'd been heading, wobbling from the raging pain in his leg, but going full speed nonetheless.

"I don't know how long we've got!" he cried to Rebecca Thalberg. "Get the hell out!"

Thalberg needed no further encouragement.

And then they ran as they'd never run before.

* * *

The tyrannosaur's screams followed them for a long time, fueling their motivation to continue their swift dash.

Whether it had finally been able to right itself was hard to say. Ian suspected it had, but by that time they were far enough away for it to have lost substantial scent of them. Just the same, although they slowed down their run to a jog, they wanted to get as far away from the giant thing as possible.

"Huge!" was all that Becky could gasp. "Huge!"

"Shut up and *move* it," Ian said, slowing a bit to match her pace. No time for niceties like "please" now. He could be the apologetic gentleman later on.

Even so, after awhile they had to slow to a quick walk. Ian darted furtive looks often behind him, without catching any sign of the tyrannosaurus. They struggled on through the land, which had grown a bit marshy, with the beginnings of a jungle-like portion nearby.

The wall was within sight, looming larger and larger as they advanced.

"Ian," Becky said, brushing past a bush, too tired to pay attention to the thorns that slid over her jumpsuit. "Ian, you saved our lives."

"Yes, I did, didn't I?" he said, too exhausted for modesty. "Entirely automatic. I just *did* it, shot the thing's leg, I mean. No use going for anything else at that point, you know. Thank God I can shoot as well as you can."

"*Better* than I can!"

They struggled through the undergrowth, pushing past fronds and ferns, careful to avoid any other large creatures. Plenty of the smaller variety,

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though, winging through the air, or scrabbling beside the boles of trees. The humid air was full of their rank smell, combined with the odor of rotting vegetation.

When they finally beat their way into a clearing, they were confronted with the spectacle of the wall, less than fifty meters away.

They stopped and stared.

At least ten meters high, Coopersmith estimated. Constructed of wooden planks, stone and mortar. Creeper vines covered parts of it. Other stretches were bare. At regular intervals were cupolas—towerlike protrusions—extensions of buttressing sections apparently thicker than the rest of the wall.

Coopersmith could see no signs of any entranceways.

But he *did* catch a quick movement in one of the roofed towers.

"There's something up there." He grabbed Becky by the hand, keeping his Magnum in his right hand, where it had been tightly clutched since the incident with the tyrannosaurus.

Together they walked up to the base of the wall, and then strode down parallel to it, toward where the tower thrust upwards.

Looking upward in wonder, almost there, Ian kicked a loose stone. It rattled off into a group of bushes.

Suddenly, something leaned over the side of the tower.

Its movements were darting, with a certain lizardlike gracefulness. Its snout was blunt, with sensitive quivering nostrils that seemed to be taking in their scent. Its head bobbed slowly back and forth as it assayed the intruders . . . a large head, atop a thin though powerful neck.

The creature was standing upright.

And the eyes . . .

The eyes were obviously capable of stereoscopic vision. As they stared down at him, Ian noted how they shone with intelligence.

Then it lifted some kind of weapon in its multifingered, obviously articulated hands, and pointed it straight down.

The weapon stared at them with tiny beady eyes and began to chitter and squawk.

THIRTEEN

"Stay very still," Ian Coopersmith said.

"Ian. Ian, what do we do?" Rebecca asked tersely.

"Something, quickly. That's some kind of weapon it's got there. Looks as though he's ready to use it, too."

They stood in tense silence. Insects droned in the nearby forest. In the near distance, just above what would be the end of this world, water vapor roiled like fog aspiring to become clouds.

The creature at the top of the tower leaned over, examining the strange intruders with eyes quite large in proportion to its head. The shape of its skull seemed to to indicate a large brain. Above everything else, though, it was a reptile.

Rebecca said, "Take off your clothes, Ian. Right now!"

She immediately began to unzip her jumpsuit.

"What? Hey, stop. I'm trying to

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think of a way to communicate with the thing before—''

''Shut up, you jerk,'' Rebecca demanded, pushing down the pants, peeling them quickly off. She kicked the clothes away, stood, and stared up to see what the response was.

The creature pulled the weapon slightly back, no longer aiming it. Its mouth seemed to drop. A long tongue issued forth, as though tasting their scent. It hissed. Its eyes seemed to grow bigger.

''So strip,'' Becky said, ''and let him see the male of the species.''

Ian Coopersmith quickly removed his clothes. ''We should show we've no weapons,'' he said, holding up his hands, then slowly turning around. Becky followed his example, turning a complete circle.

''Now what?'' she asked.

''Hey,'' Ian said, ''this is *your* strategy. You tell me.''

''Hey yourself! We're still alive, aren't we?''

''Point taken. Quite a good course of action, actually. I should have thought of it myself.''

''Congratulate me later, okay? I'm still scared witless.''

''We've found our intelligent life, anyway,'' Ian said. ''Let's just hope they're not much like humans who shoot first and ask questions later.''

The lizard abruptly pulled back from the tower's edge and disappeared. ''You've offended it!'' Becky said, joking. ''Maybe you shouldn't have taken your clothes off, after all, Ian.''

''Thank goodness a blush doesn't show up very well on my skin color,'' Ian sighed. ''I guess we should just stand and wait.'' He collected his jumpsuit, rolled his gun and holster inside it, then tucked it under his arm. ''This is the last stop, Becky. We're playing all our chips on this number. Okay?''

''I'm too tired to say anything but 'yes'.''

They didn't have to wait long. Within five minutes, a gate about one hundred meters to their right opened. A party of the upright reptiles—some ten in number—issued forth. They strode forward with a sleek grace, torsos leaning forward, balanced by their tails. As they neared, Becky noted that they carried weapons. Spears and wooden swords, it appeared. Evidently their culture did not use metal. That made sense. There would be no reason for ore deposits in this artificial geology. And the alloy past the soil and on the sides would of course be too hard to chip away.

Becky's only relief was that none of them carried one of those living weapons. That gave her the creeps.

''Becky, this may sound stupid, but—''

''What, Ian.''

''Would you hold my hand?''

She slipped her palm against Ian's, and they laced fingers. ''You know, Ian, no matter what happens, no matter if we get saved and go our separate ways or what, I want you to know that I love you. First person always.''

Ian sighed deeply and glanced up at the approaching lizards. ''I hope all *this* world loves people in love.''

When the intelligent lizards reached the naked couple, they formed a wary circle around them, brandishing weapons. They buzzed with conversation. Their language appeared to be a com-

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bination of hisses, clicks and guttural groans.

Ian raised his hand and forced a smile. "Good afternoon. I want to assure you that we're quite harmless. We need help."

"Ian, they can't understand you."

"True, but they might understand the tone of voice."

"My God, I feel like an animated version of that picture on the Pioneer trip."

"All we need now is a little Chuck Berry music," Ian quipped uneasily.

"You know, Ian, they've *all* got those little shirts around their torsos. That's what I noticed about the one in the tower."

"Women. Always fashion conscious."

"No, really. I wonder what it could mean. Clearly they don't wear it for warmth or protection or modesty."

"Caste symbol?"

"Could be. Could be just decoration, although they are rather plain pieces of material. Some kind of faded green plant fiber apparently. The things can't last long. Look. That one there. He's pointing at us. Isn't he the one from the tower?"

"How can you tell."

"He's cuter than the rest."

The reptile was jabbering excitedly, looking from companion to companion as though trying to convince them of something. He seemed to get the positive response desired.

He ceased his talk, then suddenly stepped forward three paces, directly facing Ian and Becky. With a four-fingered hand, he tugged at his little shirt.

"He's trying to talk to us," Becky said. "No. We don't have any of those shirts. We're not *like* you, are we?"

"Now who's whistling in the dark?" Ian said.

With a hiss of what might have been exasperation, the reptile began to tear his shirt open from the bottom. The others screeched with excitement and immediately began to move in on him, brandishing their weapons. The reptile immediately stopped tearing his shirt and held his hands straight up in the air, performing some kind of complicated sign language above his head. The others immediately relaxed, and reformed their circle.

Becky was puzzled.

Ian said, "Very strange. But I think he wants us to put our clothes back on."

Becky shrugged, and complied with the suggestion.

Great hisses and gasps ensued. Evidently quite pleased with his accomplishment, the lead lizard turned back to his companions, pointing at the couple and chattering away.

"Don't look now," said Becky, "but I think that little suggestion just saved our skins."

Two of the braver reptiles sidled up to Ian and touched him. A long tongue flickered. With a strained smile, Ian held out his hand. "Hello, there, charmer."

The lizard put the hand in its sharp toothed mouth and seemed about to bite it, when the lizard leader saw what was going on. He raced up to the offender and knocked him to the ground. The fallen lizard picked himself up, but in so doing managed to snag his little shirt on an exposed root. It ripped off completely.

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Immediately, weapons were raised. The two reptiles carrying blunt cudgels immediately bludgeoned the offending lizard senseless. It lay on the ground, barely breathing, blood leaking from one of its flared nostrils.

"Those shirts appear to be of great importance," Ian said, his nervousness still in his voice. "I suggest we keep ours on from now on. No more strip shows unless specifically instructed, okay, Gypsy Rose Lee?"

"Right."

The two lizards with the clubs picked their fallen mate up off the ground. They began to drag him back to the gate. The lead lizard made a quick motion with its four-digit hands. Immediately, two lizards apiece flanked Becky and Ian. The lead lizard executed a neat about face and began to walk forward.

"I think we've been invited inside," said Ian.

"I don't think it was an invitation," Becky said.

As soon as they walked through the gate, the door was closed and a set of huge logs fitted over its latches. Ian Coopersmith barely noticed. He was too busy examining the cluster of buildings grouped off to the left.

"Evidently, we were lucky enough to stumble upon a city or town of some sort."

They were hustled forward quickly. All of the previously scurrying lizards stopped with reptilian suddenness as they caught sight of the new arrivals.

"They rather look like ostriches with outsized skulls, don't they?" Ian commented as they strode toward the grouping of buildings.

"*Saurornithoides,* Ian," Becky said excitedly. "I thought they looked familiar. There's been speculation that this kind of dinosaur might have actually developed intelligence if most classes of dinosaurs had not become extinct."

"I thought they'd all become extinct."

"No. For example, birds are direct relations to dinosaurs."

"Well, I guess we're going to meet the rest of the family. They're taking us over to the big stone building yonder."

It was the largest structure of the village, a quonset-hut type of building composed of stone and brick and wood. The other houses seemed more like shacks that may have been erected with some sense of alien aesthetics or geometry. To Ian, they just looked ramshackle. Strange tinklings filtered through the air. Exotic and varied scents wafted with the breeze. Some kind of bazaar seemed to be holding forth in what appeared to be a market place. Lizards sat behind oddly shaped stalls, engaged in sales and barters. Musics of clanks and rattles and whistles were in the air, beside the tastes of charred meat.

"Oh my God, Ian. Look!"

She managed to point, despite the reptilian hands restraining her arm. Beside one of the stalls was a rack. Upon the rack on wooden hooks were hung what appeared to be the dead bodies of saurians.

"They're cannibals," Ian said. "It follows, doesn't it?"

"Yes. Reptiles have been known to eat their own kind."

"You don't think they're going to eat *us,* do you?"

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"Unlikely. They *are* civilized, and in civilized cultures curiosity tends to outweigh hunger. If they have leaders, I think they'll want to notify them, if for no other reason than to allow them a look at us before they pop us in the pan."

"Ian!" she shivered.

"If I wasn't so fascinated, I'd be scared shitless."

As they neared the building, a small iguanodon emerged from its rear, bearing a rider in a saddle that appeared to be part of the beast. The saurian manipulated a series of raised bumps in the back of the iguanodon's neck. It stopped in front of the party.

"Incredible," Ian said. "It looks as though many of the adaptations that the intelligent lizards have made have been biological. I would bet that since they were not able to advance technologically, they've concentrated on the biological aspects of progress."

"Like the living arrow that cutie-pie was pointing at us."

"Exactly."

"Cutie-pie" scrambled forward and began to confer with the creature atop the iguanodon. After much chatter and arm-waving, the saurian pushed the neck nodes of his beast, and drew the iguanodon so close to Ian and Becky that they could smell the beast's bad breath and see the tiny parastic insects that crawled in the folds of its hide. The saurian leaned over, staring intently at the new arrivals. Nictitating eyebrows blinked twice from side to side. Suddenly, it drew back upright in its saddle, and spoke again to the party's leader, pointing one of its digits at the heavily bolted door of the large building.

"Cutie-pie" barked orders.

Three saurians broke ranks with the party and scurried over to the door, which they proceeded to unlatch. The four saurians in charge of Ian and Becky pulled them forward.

The door swung back. Growls and squawks and hisses issued forth from the dimness within. Becky and Ian were pushed brusquely inside.

Torches shuddered. It smelled musky and dank, of earth and urine and rotting meat. As Ian's eyes adjusted to the dimness, Ian saw that the whole place was one large chamber, filled with covered stable-like arrangements of cement and brick.

"It's like a prison," Becky said, her voice quivering. "Why are they putting us in a prison?"

"I don't know," Ian responded uneasily.

They were hustled forward brusquely. From inside the stalls, he could hear the scraping of claws, the gnashings of teeth. Guards patrolled each aisle, holding heavy clubs.

"Cutie pie" strode forward and talked to one. The guard stared wide-eyed at the alien arrivals, then motioned for "Cutie-pie" to follow with the "prisoners." The saurian guard unlatched a door. Wielding his club, he stepped into the darkness. A great din of hissing and growling ensued, abruptly ended by the dull thud of heavy wood against soft flesh. The guard emerged, dragging with it the unconscious body of another saurian. The saurians standing abreast Becky dragged her into the cell.

"Ian!" she cried.

"Nothing I can do," Ian said. "You'll

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be all right," he said, sounding as unconvinced as he felt.

After some moments of activity inside the cell, the saurians who'd taken Becky inside withdrew. The guard slammed shut the door and latched it.

With no further ado, Ian was shuffled to the adjacent cell. The guard opened the door, and entered. No hisses. No growls. He withdrew and Ian's saurians took him inside.

The smell was terrible. Offal and straw. Vaguely, Ian could make out bowls of some foul stew in the corner beside a trough of water. Roughly, he was seated in a bed of straw. Stone manacles were placed over his hands and his feet. They seemed connected by some ultra-strong vines to the wall. The arrangement allowed him some movement—perhaps as far as the food—but not much.

He hunkered down wearily in the dirty straw, as the door was slammed shut on him. At least he'd get some rest here. He could use some. Yes. He certainly wouldn't mind a few hours of sleep safely tucked away from the constant fear of being eaten by some prowling dinosaur.

Sighing, he shut his eyes as saurian feet stamped away from the cell.

In the quiet, he heard soft, harsh breathing that was not his. It seemed to come from the other corner of the cell. A hiss. A strange mumble, like a sleeper might make.

He was no longer relaxed.

What the devil was going on here? Had they stuck him in a jail cell with a maniac saurian? But why? It didn't make sense. None of it made sense.

At least, it didn't make human sense. He supposed that in order to understand it all, he'd have to think like a saurian.

But how did a saurian think? There could be no comparisons. Or could there?

Ian remembered the biology courses he'd had to take in University. Requirements for a "liberal" education.

He thought about the human brain.

The R-complex. That was the key. That most primitive part of the human bio-computer. Man's inheritance from his reptilian past.

Something scratched on the other side of the wall Ian leaned against. A human voice called, "Ian? Ian, are you over there?"

The creature in the corner stirred uneasily in its straw bed in the corner. Jaws snapped together.

"Becky," Ian said. "Please be quiet. There's something inside here with me that I don't want you to wake up."

"What? Ian, speak up! We can talk to each other. Ian, I'm frightened. What are we going to do?"

"Becky! I asked you to be—"

The creature in the corner snorted. In the dimness, Ian perceived movement. The saurian stood. Straw rustled.

"Oh, God," said Ian, preparing to defend himself.

The saurian bellowed and clicked its strange language. It seemed to be more nervous about being in the cell with Ian than Ian was.

"Ian! Ian, what's going on. Are you all right? Ian, answer me. I'm scared."

"*You're* scared!"

After a few more moments of the creature's loud calling, the door swung open again. The saurian guard ex-

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changed a few words with the other prisoner, then slithered in and released it.

The former prisoner excitedly pointed at Ian and spoke a few grunts that might have been, "Who or *what* the hell is *this* thing in my cell?"

The guard growled, and led the saurian out, then closed the door behind it.

"Becky," Ian said in a loud voice.

"Ian! What happened!"

"Goodness knows, but I think it's going to take a lot of thought to try to understand this culture."

"If we live long enough to think," Becky answered. "Ian," she said after a few moments of silence.

"Yes."

"I'm not sure, but all in all I think even living with Phineas Kemp would be better than this."

They both laughed.

FOURTEEN

Kemp bent down to pick up the discarded ration-pak. It was lying by the long-dead ashes of a fire-pit by the entrance to a small limestone cave. "Anything in there?" he asked of Mikaela Lindstrom, who was still inside the cave.

There was a pause before he saw her blonde hair coming out of the darkness. Her bright green eyes were shining like a cat's as she appeared, carrying a small object. "This must be what set off the metal-detector," she said, handing him a small communications unit. The metallic surface was already showing signs of corrosion from the fierce humidity of the interior.

"At least *somebody* survived," said Phineas. "Long enough to get this far, anyway."

Looking up into the surrounding treetops, and the bright hazy sky beyond them, he was again reminded of the scope of the ship's interior. Despite his anxiety, he could not deny the sense of awe, and dread, when he thought about the beings who had *built* this place.

"Presuming that they could not find their way back to the entrance hatch," said Phineas, "why would you suppose they would be making camp this far away from the general area—they couldn't be *that* lost."

"They?" said Mikaela.

"I'm assuming, and hoping, that there was more than one survivor. Anyway . . . it seems like they were moving away from the general direction of the base camp."

Mikaela looked up at the illuminating rod, high in the sky. "They're heading towards the aft section of the cylinder?"

"Maybe. If Coopersmith made it, I'd bet that he was trying to reach the part of the ship where the engines are located. And then maybe find a way into the alien crew-quarters."

"I wonder if they made it. . . ."

"Hard to tell how long ago they were through here. Going through this forest on foot must be hell. But we know now at least that we should be out looking for them." Kemp looked back to the omni-terrain vehicle, where Richards, the driver, and Nordman, the weapons specialist, both kept watch with razer rifles. "And we're going to need something a little faster than the OTV. Too damned slow."

"The ornithopter?" asked Mikaela.

"Yes, I've got them bringing the

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thing in in pieces now. As soon as we can get it put together, I'd like to get started."

As they began walking back to the OTV, Mikaela touched his arm, and Kemp felt his pulse jump a bit. "Phineas?"

"Yes?"

"I know this might sound out of line, but would you mind if I went along with you in the 'thopter?"

"Part of the search party? I don't know . . . I've been thinking about that. If you didn't come, I would miss your company, but I don't want to put you to any unnecessary risk. It's not your responsibility, you know."

"I know that. But I could use the chance to survey more of the environment. I won't get in the way, I promise. . . ."

"I wasn't worried about that," said Phineas, managing a small smile, but feeling awkward doing it. He was attracted to this woman, and now that he had renewed evidence that Becky might still be alive, he didn't know how to deal with his new feelings.

Mikaela smiled back. She *was* a pretty woman. "Then it's a deal?"

"It's a deal."

Richards stopped the OTV, waiting for the guard on duty to deactivate the perimeter-field, then guided the ungainly vehicle into the base-camp. As they approached the main dome, Phineas saw Doctor Robert Jakes waiting for them.

"Colonel!" said Jakes over the dying whine of the OTV's engines. "I've got to see you right away."

Kemp opened the door and jumped down, then guided Mikaela down, before turning to face the engineering specialist. "What's up, Doctor?"

Jakes looked at Mikaela Lindstrom and the two others climbing down from the OTV. "I'd like to speak with you privately, Colonel."

Kemp looked to Mikaela for a moment. Mikaela grinned, and began walking towards the lab-dome. "I've got some work to do anyway," she said with no apparent hurt feelings. "See you later, and thanks for the ride, Colonel."

Phineas wanted to say something, but she walked away quickly. It was an awkward moment, and he felt some resentment towards Jakes.

"Please, Colonel. It's important." Jakes's thin face looked even more dour and grim than usual.

"All right, what is it?" asked Kemp as they began walking towards his offices in the main dome.

"The communications modules," said Jakes.

"Trouble?"

"Bad trouble. They're damaged so badly that I'm not sure we can fix them. . . ."

"What? What could have happened to them for it to be *that* bad?" Kemp stopped and looked at the engineer, while his mind wrestled with the new idea that the operation might be totally cut off from Copernicus Base.

"I tell you what *did* happen, Colonel. Somebody sabotaged them. They knew what they were doing, too. Everything's fouled up pretty good. Used a magnetic-driver and welding torch . . ."

Kemp did not speak right away. His mind was reeling with added knowl-

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edge, and the implications attendant. *Sabotage. Christ, what else can happen?* But for what reason? He couldn't believe that anyone would want the alien ship destroyed. What the hell was the purpose in cutting off their link with Copernicus Base? And who did it?

"Colonel, are you all right?"

"What? Oh, yes. Sorry, Jakes. And you say there's not much chance of getting things fixed?"

"We can try . . . I don't know."

"How many people know about this? Anybody see anything?"

Jakes shook his head. "I had two of my men down there to check out the problem right after it happened. They didn't see anybody. I told them to keep their mouths shut, and *I* haven't said anything about it, other than that communications are down for the moment."

"I can't believe this," said Kemp. "Everybody on this mission's got top-level security clearance . . . It's almost impossible that they could get somebody on board, presuming that they knew about the mission in the *first* place."

"Who's *they*, Colonel?"

"The Third World Confederation, who else? It's obvious what this ship represents, and if they do know of its existence, they would want it for themselves—just as badly as *we* want it."

"What do you think their next move is?" Jakes rubbed his chin, cast a quick paranoid glance about the camp to see if anyone was watching them speak.

"That's hard to say. They don't have any ships fit for deep space operations . . . but they must have some kind of large plan involved. Damn it, I just don't believe this is happening, that's all!"

"I'm afraid it is, Colonel."

Kemp shook his head, rubbed his eyes. "All right, Doctor, why don't you see what you and your men can do about patching us up? Check back with me later."

Jakes nodded and walked towards the entry hatch. In the clearing just below it, some of the crew were working on the ornithopter. It was almost completely assembled and looked like a giant mosquito with large gossamer wings and a pair of helirotors above its thorax.

Colonel Kemp stood watching the work on the ornithopter for a moment, knowing that he also had the responsibility to whomever might still be alive out in the interior, but his mind was getting jumbled. Too many things happening too fast. He walked towards his headquarters wrapped in thought.

"Will that be all, sir?" asked Captain Marshall, who was standing stiffly before Kemp's portable work-table. The man was a model underling—efficient, trustworthy, and ultimately boring. Kemp knew that Marshall would follow his instructions to the letter because of his lack of imagination to do otherwise.

"Yes, I suppose so, Captain." Kemp did not look up from the notes he had been making on a small pad. "Oh, one more thing. Has the ornithopter been checked out for flight yet?"

"Yes sir. It's fine. Lieutenant Zabriski's taken her up. It'll be ready when you are."

"Very well, Captain. Have it loaded

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up with the gear, and tell the others we'll be lifting off in about ten minutes."

Marshall saluted laxly and left the room, shutting the door and leaving Kemp alone with his thoughts. A small air conditioning unit hummed in the background.

Phineas should not have been surprised to know that Marshall was aware of the sabotage, but he *was* angry. Apparently the men who had discovered the mess had opened their mouths, and now the whole crew was looking at one another, wondering if they were staring into the eyes of a traitor. That kind of tension wasn't good, but Kemp was powerless to do anything about it.

The only good thing he could be certain of was that the outrigging operation had gone smoothly and *Artifact One* (even now, he clung to his original name for the alien ship, disdaining the more popular "Dragonstar") was being gently but inexorably shifted out of its cometary orbit and onto a course which would intersect with the Earth-Moon system.

But everything was ganging up on him. Not knowing if Becky might still be alive; his feelings for Mikaela; the lack of contact with Copernicus; an espionage agent loose among the crew; and the growing feeling that the TWC had more tricks up their sleeves.

As a precaution, Kemp had Fratz and Bracken monitoring the long-range detection scanners, in the event that anything might be approaching them as they drew closer to Earth orbit. Even if it was an IASA vessel, Kemp wanted to know about it way ahead of time. He wanted a safe margin in which to operate, especially if he might be out in the 'thopter when more trouble started.

Damn it, he thought. If it wasn't for Becky, and his conscience, he wouldn't be taking personal command of the search party flight. . . . Sometimes he didn't know *what* he was feeling.

For the first time in his career, in fact, he considered taking something for his nerves—one of the little green capsules which were standard issue in all Mission medkits. He reached into his desk drawer, where he kept a small pack of them, opened the container and looked at the capsules. He wondered why they were called "little green monsters" by everyone.

No, not now, he thought. *If I've gone all this way without them, I'm not going to start now.*

Slamming shut the drawer, he got up and went outside.

The ornithopter's engines whined softly behind the cabin, just loud enough to make everyone speak loudly without really yelling at one another. Including Kemp and Lindstrom, there were three others on board—Zabriski, the pilot; Michaels and Nordman, who were both expert marksmen with a razer-rifle.

"Ready to lift off, Colonel," said Zabriski.

Kemp nodded, and the odd-looking craft leaped into the air. It was a mechanical hybrid, combining the actions of a helicopter and a bird, and was exactly the kind of craft needed to operate in a closed air-space that was full of tricky flying conditions, such as the rotating, vortices-full, atmosphere of the *Dragonstar*.

As the base camp dwindled in size, and Zabriski headed for the aft end of the cylinder, Mikaela began studying

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the terrain below with a pair of electronically-magnified and adjusted binoculars. She carried a small recorder on her lap, and occasionally she recited a particularly important observation. Kemp watched her at work, and was pleased to see that she was one of those people who were truly dedicated to their job. There simply weren't enough people around like that anymore.

Zabriski remained hunched over his controls, a tense expression on his homely features. "We've got to watch ourselves in here, Colonel. . . . There's a 'gravity gradient' which increases sharply as we increase altitude. Also some funny air currents. Doctor Jakes said it has something to with the atmosphere not rotating at the same speed as the land mass."

"Stay as low as you can," said Phineas. "I want to keep an eye out for any sign of them down there."

Zabriski gave a thumbs-up signal and continued staring straight ahead. The view was spectacular, even from the relatively low altitude of 1,000 meters. The mind was continually trying to reject the image of the upward curving land mass and the lack of horizon. In addition, when you looked down the length of the cylinder, the lines of perspective closed in, and gave you the impression that you were falling down a bottomless well. But Kemp knew that more than 250 kilometers distant, this particular well *did* have a bottom, and they were betting on logic and ingenuity of the survivors to have headed for that spot.

Several times the ornithopter would buck or dip as it passed through a thermal bank, or the residual wash of an atmospheric vortex. Kemp wondered if the heat-energy of the illuminating rod in the center of the cylinder was heated to varying temperatures so that gradients would be produced to create artificial weather. If that were so, it would help explain the turbulence experienced by Zabriski.

"Everything all right, Captain?" Kemp leaned forward with his most serious expression setting his features.

"Yeah, Colonel, but I'll tell you . . . this is the damndest ride I ever took. I've flown everything there is to fly, just about, but this is one hell of a ride! I don't recommend airspeed much above a hundred klicks per hour."

"That'll be fine, Captain. Just take it as it comes. . . ."

The craft continued to pitch and dip occasionally, but Zabriski seemed to be learning some of the interior atmosphere's tricks, and he was having less difficulty as the flight progressed. But Phineas hardly took notice.

At least he was *doing* something now. He had never been the kind of person who could sit still, letting somebody else get all the action while he directed things from an armchair. He had considered staying back at the base camp, now that the sabotage was known, and that it was a good bet that the TWC would be trying something else. . . . But he doubted if he could have withstood the *waiting*. The sheer tedium of simply sitting around *waiting* for something to happen would have brought him that much closer to the little green monsters in his desk drawer.

They flew on for another two hours, passing over three areas which had Lindstrom so excited that she was al-

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most falling out of her seat. The discovery of stone-block ruins, their peaks above the green carpet of the forests, were a surprise to everyone. Lindstrom insisted that they land and investigate. Kemp agreed, thinking that it was possible that the survivors might be there, or at least some sign of their presence.

The first set of ruins, simply post-and-lintel constructions, yielded little except some ideas from Mikaela that there was intelligent life in evidence. Kemp countered with the idea that the building might be the work of survivors from the original alien crew, or perhaps their descendants who worked their way out into the cylinder once all the supplies within the crew section had been exhausted.

Later on, they landed at a group of three pyramids, where Kemp and his men found evidence of a campsite. Once again, he felt hope rekindled in his heart, and the feeling was growing stronger that Becky and probably Coopersmith were still alive. If they had learned to cope with the primitive environment well enough to get *this* far along, they were probably going to still be alive. Mikaela Lindstrom wanted to stay on long enough to make some sketches of the pyramids, but Kemp was getting impatient. So much so that he did not want to land at all when they passed over the remains of an ancient city. Mikaela was upset with the decision, but something else had just become visible in the distance ahead of them. The flat end of the giant cylinder was now becoming clearer.

Mikaela had been talking about how many of the dinosaurs so far observed exhibited discrete changes in their somatotypes when compared with the fossil records. She said that it was most obviously due to genetic mutation and the continuing evolutionary process, despite the constant, controlled environment of the *Dragonstar*. She felt that over the 150 million years or so, it was possible that evolution had produced some intelligent species, although it would be difficult to predict whether representatives from the saurian or mammalian families existed.

". . . and you'll have plenty of time to test out your theories," Kemp was saying in response, when Zabriski cried out excitedly.

"Colonel! I've got something coming up down there. Looks like a mountain range or something . . . see it?"

Kemp looked down and ahead of them to see a long low ridge stretching across the landmass, extending through the thick forests, and curving upwards as though endless. As the ornithopter dropped down to a lower altitude, the definition of the ridge became clearer.

It was not a mountain range.

"I don't believe it," said Zabriski.

Kemp did not reply for a moment, but continued to stare in amazement at the structure looming ahead of them. It was undeniable now. It was a gigantic *wall*, perhaps ten or fifteen meters tall, a barrier, with buttresses, and towers spaced at even intervals.

The ornithopter slowed and hovered over the incredible wall, as everyone looked down upon it, and what lay beyond it.

A city.

A living city.

TO BE CONCLUDED

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BRASS TACKS

Dear Dr. Schmidt:

I was interested in your statistics in the 4/27/81 edition ("Portrait of You"). I am inclined to believe them, being one of the higher-income people who did not respond and a reader of *Astounding/Analog* since my teens in Ireland. My profession (law) is woefully underrepresented, and many lawyers could have profited from the rigorous analyses of John W. Campbell's editorials.

The story "Rule of Law" (April 1981) would not have passed Campbelltonian scrutiny. You should not have been so deferential to a lawyer who, after all, pushes a scientific thesis.

I have no quarrel with the basic premise: that computerization can be a very useful tool. It certainly is, where legal research is involved. My old firm once tried to categorize one federal court of eighteen judges as to one specific inclination, though, and the results of that poll would have given a programmer the horrors. The human interrelationships were such that it was decided that, insofar as possible, cases would be assigned to the lawyer who liked the assigned judge. That, after all, is the tried-and-true method of picking a juror, psychological profiles notwithstanding; if you like a juror, he or she will probably (hopefully) like you.

What I did not like about the story and what would have given John W. the collywobbles, I suspect, is the notion that a federal government which dopes suspects would leave an independent federal judiciary intact. This subplot was quite unnecessary to the main theme, was not developed beyond the "of course the government does such things" stage, and the consequences—the

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dichotomy of a repressive government and an independent judiciary—naively uncomprehended. Governments appoint judges. Judges follow the law. If doping suspects becomes a recognized government practice, judges will recognize it as legal. John W. Campbell would not have let the author slip such a subliminal idea by him and would, I'm sure, have made the author put up or shut up in this regard.

As to the main theme, that public defenders and poor folks' lawyers will be at a disadvantage because computers are so expensive, I think a good sound story has been missed. The present fact of life is that the big law firms already hire the best computers—the human brains—right out of law school at salaries the public cannot afford. On the other hand, if computers could be made to do what the human brain now does, the tendency would be towards equalization. Computers are for the volume market, remember, and there are more poor than rich folks' lawyers.

I am afraid that I cannot let you use my name or even describe my position should you use this letter for publication. Feel free, however, to use the ideas herein without fear of plagiarism; the first rule of any trial lawyer is that litigation is to be avoided at all—well, almost any—cost. And, for a judge at any level, anonymity is everything. We want to thwart those programmers.

(Name withheld by request)

Actually, I have a nasty suspicion that your description of what already *goes on is a shade too simple and idealistic. But, under the circumstances, maybe you know more about it than I do. I hope so, anyway.*

Dear Stan,

I don't hold it against you, but letting Tom Easton publish misguided speculations about the spaceport and the Boeing Company (The Reference Library, February 1981) is a dirty way to get me to send you an update on the concept.

To begin with, the work I did in developing the spaceport concept and in writing the *Analog* articles with Don Kingsbury was entirely independent of my work at Boeing Aerospace. BAC was never involved, either directly or indirectly, and deserves neither blame nor credit for my wild ideas.

Alas, I did not receive a promotion, as Mr. Easton apparently inferred from his conversation with Don, as a result of developing the concept that Don and I wrote about. It is true that, at roughly the time the article was taking shape, I transferred to my current job in BAC's Engineering Technology organization. But it was a case of an opening that came up and looked interesting—not something related to what I did on the spaceport article.

So what actually is Boeing's position concerning what Don and I wrote about? The answer is that, officially, Boeing has no position whatsoever. I have never formally petitioned management to fund studies of the concept. Independent R&D funds are always in short supply, and tend to get spent either in competition for new business contracts or for projects with obvious near-term commercial payoff. The orbiting spaceport does not fit either of those categories. It is unfortunate, but those are the facts of aerospace life in this day and age.

This situation should not be taken as cause for despair by readers who were intrigued by the *Analog* articles on the spaceport. When Arthur Clarke wrote

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about communications satellites in the '40s, he was describing a concept which physics and his engineering intuition told him was feasible. He knew that communications satellites would eventually be built and would create a new era in long-distance communications. He never expected to see them in his lifetime, yet it took a scant twenty years for them to move from the arena of wild speculation to practical reality.

The spaceport concept now is probably where the communications satellite concept was in the late '40s, more or less. I cannot presently envision what its form will be when it gets built or how soon that will happen. But I know it is technically feasible, and the advantages it offers for climbing in and out of Earth's gravity well are so fundamental that its eventual construction is all but inevitable.

As to the near-term, I intend to continue with concept development for the orbiting spaceport, as spare time permits. In light of recent literature, it seems that I was very conservative in estimating the performance that can be achieved in electromagnetic acceleration and braking systems. That's good news, of course. I also have worked out the details of a vehicle guidance and control system to the point of proving that ultra-high-speed rendezvous between spaceport and shuttle vehicles is feasible. What I still need to make the whole idea credible are solid, defensible estimates for the structural mass of the spaceport, plus control algorithms for the active structure and computer simulations to prove that the thing can be kept stable.

Once these preliminary studies are completed, I will be in a position to write serious technical articles and study proposals. With luck I will be able to persuade someone to pay me to do full-time what I am now forced to do only as a hobby. In the long run, though, it's not going to matter whether I'm personally successful in promoting the spaceport concept. With the launching of the space shuttle, the U.S. has taken the first steps on a path leading to the industrialization of space. As commercial applications increase and the payoff potential for large-scale space operations is proven, the spaceport will look more and more attractive. Eventually someone will build it. In the meantime, I'm happy to have been able to help place a new idea in the public domain.

ROGER ARNOLD

Vashon, WA

Sorry you find our tactics low-down and sneaky; actually, we weren't even thinking in those terms. But we do appreciate the update.

Dear Mr. Schmidt,

In your December 1980 issue you were kind enough to run my letter concerning our upcoming *The Letters of John W. Campbell*. Since then I have received anguished letters concerning the statement that only Campbell's side of the correspondence would be published. This policy was entered upon at the time because it seemed to us then that the problems of access, copyright, etc., would rule out a large amount of the answering letters; it was not that we did not want to run them. In fact, I am happy now to state that cooperation from members of the Campbell "stable" has been more than generous, and that a very high percentage of the incoming letters will in fact be carried. When I say that this correspondence is "interesting," I am probably making the understatement of all time. . . .

GEORGE HAY

London House
Mecklenburgh Square

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P.S. All general correspondence on this project should be addressed to the Science Fiction Foundation, North East London Polytechnic, Longbridge Road, Dagenham, Essex RM8 2AS, U.K.

Dear Mr. Schmidt,

I have subscribed to *Analog* for six years now and loved every issue. One story in particular has finally prompted me to write and comment.

Before I do that, I will comment on myself. You seem quite interested in who your readers are. I started my subscription when I was 17 and have just turned 24. I have been married for three years and on active duty in the U.S. Air Force for one month less. This is important because the Air Force is putting me through my last two years of college at the University of Southern California, majoring in aerospace engineering. I will graduate in May of 1982 into a world that would be unbelievable to me if I were not living in it. Talking machines, incredible computing power that can be carried in the hands, and a machine the size of a DC-9 going to and returning from space all in one piece.

Each semester I learn some piece of knowledge which literally thrills me. Some physical or mathematical concept which is so beautiful or elegant that it alone is worth all the years of study to reach the point of being able to comprehend it. Maybe this is part of the reason why I love *Analog*. Here is the grandness that is the universe enriched by the grandest thing of all: the human intellect and imagination.

That goes beyond what I had originally wanted to say in this letter, but certainly expresses how I feel. Anyway, back to the original intent.

"Emergence" was the best diary-type story that I have ever read. It was also one of the best stories of any type that I have ever read. I laughed and cried and loved it thoroughly. If there is no sequel forthcoming, I, for one, will be greatly disappointed. I do not mention the author's name because I lost my copy of that issue. Fortunately, I did remember the title to be able to tell how much I enjoyed the story.

Two other stories fall into this category of begging for a sequel: "The Cloak and the Staff" by Gordon R. Dickson and "The Tides of Kithrup" by David Brin. Both of these stories are rich in possibilities, and I would buy and read an entire book of either one without any hesitation.

"Grotto of the Dancing Deer" by Clifford D. Simak and "The Bully and the Crazy Boy" by Marc Stiegler also deserve mention as especially memorable stories whose authors are to be commended for their fine work.

Please keep up the good work. Bring me the stories that make me laugh and cry and wonder. I have read voraciously since I was seven or eight years old, most of which was science fiction and fantasy, and *Analog* has given me the best. If I can ever overcome the fear of rejection and general mental laziness (excuses, excuses), I will submit a story or two of my own. They are here, just waiting to be set down in print.

VERNON J. BLOMQUIST
Los Angeles, CA

"Emergence" was by David R. Palmer, a new writer from whom many of us hope to see more. As for submitting your own stories, please do, and don't worry too hard about being rejected. We reject most stories we get, because we only have room for about 1 percent of them—but we never reject the people who wrote them. ■

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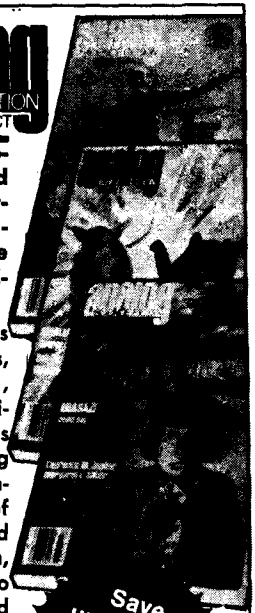

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